

NEWS FROM THE UNDERGRADUATE RESEARCH CENTER

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Posters at the Capitol

Congrats to our MTSU Presenters!

Posters at the Capitol is the Undergraduate Research Center's most prestigious annual event, during which select MTSU students present their STEM research to state legislatures at the state capitol alongside other participating Tennessee universities. The event will take place on Wednesday, February 16th, 2022.

The Posters at the Capitol project, sponsored by the Tennessee Board of Regents and the University of Tennessee system, and hosted by Middle Tennessee State University, has two goals—to expose legislators to undergraduate researchers and to expose undergraduates to their legislators. The state of Tennessee is the beneficiary of this exciting effort.

In addition to presenting their research, students will have an opportunity to meet with legislators, network with students from across the State of Tennessee, tour the Capitol, and take a photo with Governor Lee.

We are so proud of our selected students, as they represent the best of undergraduate research in STEM at their institutions. Check out pages 2-5 to view our MTSU representatives, their abstracts, hometowns, 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: POSTERS AT THE CAPITOL 2022

**HUNTER BRADY*****Assessment of Antiviral Activity of Chlorine Dioxide Gas***

Since the emergence of the SARS-CoV-2 virus, the need to identify antiviral agents to disinfect large areas has greatly increased. Chlorine dioxide (ClO₂) gas has previously been identified as an antibacterial agent with strong oxidizing capabilities. The MS2 bacteriophage has previously been identified as a suitable surrogate for the development and application of virucide decontamination methods. The purpose of this study was to identify and assess the antiviral properties of ClO₂ gas and to determine optimum physical conditions for potential deployment in support of current antiviral disinfection needs. Using the MS2 bacteriophage model system, preliminary studies used the double-layer agar plaque assay technique to evaluate the antiviral activity of ClO₂ gas. Initial results support the use of ClO₂ gas as an antiviral agent. Reduction of up to six logs was observed with treatments of 200 ppm of ClO₂ gas following overnight treatment on a non-porous surface such as steel coupons. Lesser exposure times studies were also effective in multiple log reductions of the MS2 bacteriophage. Studies are now being directed at the ability to inactivate MS2 phage imbedded in porous surfaces such as cloth. It has been determined that infective MS2 bacteriophage can be recovered after being imbedded on a cloth substrate. This can serve as a basis to evaluate MS2 phage inactivation when imbedded in porous substrates such as cloth.

Faculty Mentor:

Dr. Anthony Newsome
Hometown: Murfreesboro, TN

**LOGAN CARVER*****The Interaction of N-MYC and WDR5: Therapeutic Potential in Neuroblastoma***

Neuroblastoma (NB) is a cancer originating in the nerve cells and the most common extracranial tumor affecting children. The survival rate for high-risk NB is less than 50%. High-risk NB is associated with increased activity of N-MYC, a transcription factor that regulates thousands of genes involved in cell growth and metabolism. Unfortunately, blocking N-MYC directly has failed to be a viable option for therapeutics, necessitating a deeper investigation into new ways to inhibit N-MYC. One novel approach to target NMYC is to target an important co-factor that N-MYC needs to function as a transcription factor. Evidence in other types of cancers has revealed that WDR5 is a critical cofactor that recruits N-MYC to genes known to be essential for biomass accumulation. The present study sought to investigate the influence of the N-MYC-WDR5 interaction on the ability of N-MYC to bind chromatin and promote transcription in neuroblastoma cells using NB cell lines engineered to induce wild-type N-MYC (WT), a version of N-MYC that cannot bind WDR5 (WBM), or a green fluorescent protein (GFP) as a control. Results reveal that N-MYC expression in the induced cell lines is comparable to other N-MYC amplified cell lines and that inhibition of the N-MYC-WDR5 interaction using the WBM cell line reduces the level of N-MYC that binds chromatin. Consistent with a decrease in N-MYC binding, transcript levels of these same N-MYC-WDR5 targets are decreased in the WBM cell line as well. These results provide a solid foundation for the use of this model system to further probe the consequence of the N-MYC-WDR5 interaction on multiple facets of N-MYC function.

Faculty Mentor:

Dr. April Weissmiller
Hometown: Nashville, TN

STUDENT ABSTRACTS: POSTERS AT THE CAPITOL 2022



MARIA CLARK

Synthesis and Characterization of the Therapeutic Potential of Antifungal Peptoid β -5

C. neoformans is a pathogenic yeast species that is one of the leading causes of Cryptococcal meningitis. This form of meningitis, which begins with the inhalation of yeast spores, has a significant mortality rate of 81% percent, with high incidence in those who are immunocompromised. Current antifungal treatments such as fluconazole and amphotericin B have detrimental side effects, leaving a significant need for better alternative treatments. Peptoids, which are mimics of the natural peptides found in living organisms, exhibit beneficial characteristics such as protease degradation evasion and therefore longer half-lives, offer an alternative route for antifungal compound development. Peptoid compounds discovered in our own lab, such as β -5, must be characterized by determining efficacy against pathogenic species such as *C. neoformans* as well as the toxicity of the compounds in the presence of mammalian cells. Herein, assays for determining these factors have shown that β -5 has low toxicity in several mammalian cell lines and significant and rapid inhibition of *C. neoformans*. These characteristics, which are linked to the compound's structure, suggest that future investigation can focus on working to further enhance the compound's overall efficacy through structural modification.

Faculty Mentor:

Dr. Kevin Bicker

Hometown: Murfreesboro, TN



DAVONTE LEWIS

From superconductor to Anderson Insulator: Harnessing disorder in quantum materials

Superconductors are 21st-century quantum materials that promise fascinating technological and societal benefits once properly harnessed. One of the hurdles we face towards that end is that of disorder: the inherent impurities and imperfections that exist in all real materials. Recently, there has been significant progress in the development of numerical tools capable of treating different ranges of disorder, allowing for a more robust investigation into its effects on the spectral and conducting properties of materials. In this work, using the in-house typical-medium theory of the single-site attractive Hubbard model on a Bethe lattice, we aim to explore the effects of strong disorder on superconductive properties. In particular, our focus is the study of disorder induced Anderson localization and the associated superconductor-insulator transition (SIT). We construct a phase diagram in the disorder and electron-electron interaction parameter space and demonstrate how sufficiently strong disorder can destroy superconductivity in materials. Studying this disorder-induced transformation of material properties is not only of intellectual interest, but also paves the way for the use of disorder as a means to tune material conductance—ultimately reframing disorder as an exploitable design parameter rather than a limiting factor in the development of novel quantum materials.

Faculty Mentor:

Hanna Terletska

Hometown: Camp Springs, MD

STUDENT ABSTRACTS: POSTERS AT THE CAPITOL 2022



Faculty Mentor:

Scott Handy

Hometown: Nashville, TN

SOPHIA TAYLOR

Synthetic Organic Electrochemistry in Deep Eutectic Solvents

Electrochemistry is an increasingly well-known method of organic synthesis due to its sustainability. Organic electrochemical synthesis requires an electrolyte, or a salt, to facilitate charge transport in addition to a solvent. Both the electrolyte and the solvent are sources of waste in an organic reaction and thus contribute to its environmental impact. Deep Eutectic Solvents (DES) are increasingly well-known recyclable liquids that contain salts as at least one of their components. The use of DES as organic electrochemical solvents is explored for the first time. By performing various allylations of aldehydes using different DES and electrode pairings and analyzing percent yields of each round, reaction conditions are optimized. The recyclability of the DES is also explored. It is discovered that DES are excellent solvents to use for electrochemical allylations because each 2 mL of DES can be reused at least three times. The combination of electrochemistry and DES yields a doubly green synthetic reaction which can be replicated in many large-scale settings, such as the pharmaceuticals industry. Doing so would minimize waste production and allow for reusable materials, saving both money and the environment.



Faculty Mentor:

William Robertson

Hometown: Shelbyville, TN

CARINA VAZQUEZ

Experimental Composition of Two Systems: Ring Resonator Structures and an Acoustic Demultiplexer

In this work, we experimentally investigated two acoustic systems: the Y-shaped demultiplexer and the acoustic ring resonator. A demultiplexer separates and transmits specific frequencies from a broadband input signal. The acoustic demultiplexer investigated here is based on resonances created by sideattached waveguide stubs. The Y shaped waveguide sent broad bandwidth sound along an input line. Two output lines with a stub filter arrangement transmitted narrow bands of two different frequencies separated from the broadband input. Ring resonators are widely used in optics as filters and switches. Here we investigated the acoustic analog to the optical ring resonator. The acoustic ring resonators consist of a circular waveguide attached tangential to a straight waveguide. The ring waveguide has resonances whenever the path around the ring equals an odd half-integer multiple of the wavelength. We showed that this phenomenon can be used to create notch filters, add-drop filters, and broad acoustic bandgap reflectors. The experimental results were in good agreement with numerical models rendered in python and finite-element simulations using.

STUDENT ABSTRACTS: POSTERS AT THE CAPITOL 2022



QUINN WILSON

Analyzing the Spectral Characteristics of Propagations Teepees

A high frequency spectral feature has been previously identified in ground-based spectrographs and recorded by a group of citizen scientists from the Radio JOVE project (Fung et al., 2020 GRL, 47, e2020GL087307; <https://doi.org/10.1029/2020GL087307>). This feature is a teepee (TP) tent shape found in data between 15 to 30 MHz, where the spectral enhancement frequency increases and then decreases with time, hence the name (Figure 1). The presence of these features is currently being attributed to ionospheric reflection of VHF emissions from lightning activities in remote thunderstorms. In this study, we will analyze TP observations by studying their times (seasons) of occurrences, duration, apex frequency, upper cutoff frequency drift rates, and quality, to better understand these spectral features. Analysis was completed using the Autoplot software (<http://autoplot.org>), and these characteristics and statistics are presented in order to gain a deeper understanding of these peculiar spectral features.

Faculty Mentor:

Chuck Higgins

Hometown: Smyrna, TN

The MTSU cohort will travel to the Tennessee State Capitol alongside the following universities:

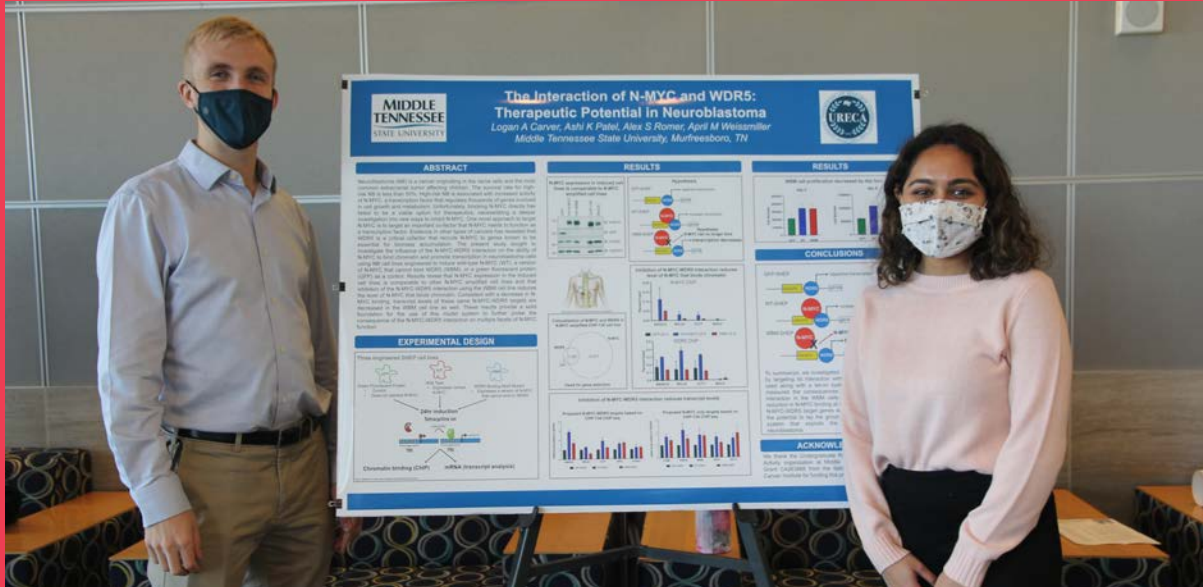
- Austin Peay State University
- East Tennessee State University
- Middle Tennessee State University
- Tennessee State University
- Tennessee Technological University
- University of Memphis
- The University of Tennessee at Chattanooga
- The University of Tennessee, Knoxville
- The University of Tennessee, Martin



Be sure to check out our March newsletter with pictures from the event!

SPRING URECA GRANTS

APPLICATION DEADLINE: JANUARY 27TH, 2022 BY 4:30PM



*Want to get paid to do research
or work on a creative project?*

THEN CHECK OUT OUR
UNDERGRADUATE RESEARCH AND
CREATIVE ACTIVITY GRANTS



To support our vision of nurturing a culture of research and creative activity at MTSU, the URC offers Undergraduate Research Experience and Creative Activity (URECA) grants to students three times a year. Awards range from \$500 for beginners to \$3,500 for experienced researchers.

Team applications are now being offered during the fall, spring, and summer semester. More information about the team structure can be found [here](#).

To learn more about URECA grants and how to submit proposals, check out our [website](#).

NEW!! Need assistance finding a mentoring or figuring out which level grant is best for you?

Contact our Peer Mentor Scholar, Jared Frazier, at jf5s@mtmail.mtsu.edu. Jared can also help with proposal development, budget and justification, creating a timeline, and proposal review. More info on the next page about our new SOAR Ambassadors!

Also, check out our virtual workshop! This YouTube video features several of our undergraduate researchers and provides an overview of the services we provide in the URC. It also walks students through the necessary steps to apply for a URECA grant. [CLICK HERE](#) to access the video.

STUDENTS MAY
APPLY FOR THE
FOLLOWING
LEVELS:

Assistant - beginners,
one semester
project, \$500 stipend

Silver Scholar -
experienced student
researcher, one
semester project,
\$1000 stipend

Gold Level -
experienced student
researcher, 2
semester project (fall
& spring), \$2,400
stipend

Conference Spotlight

National Association of Biology Teachers (NABT) Professional Development Conference

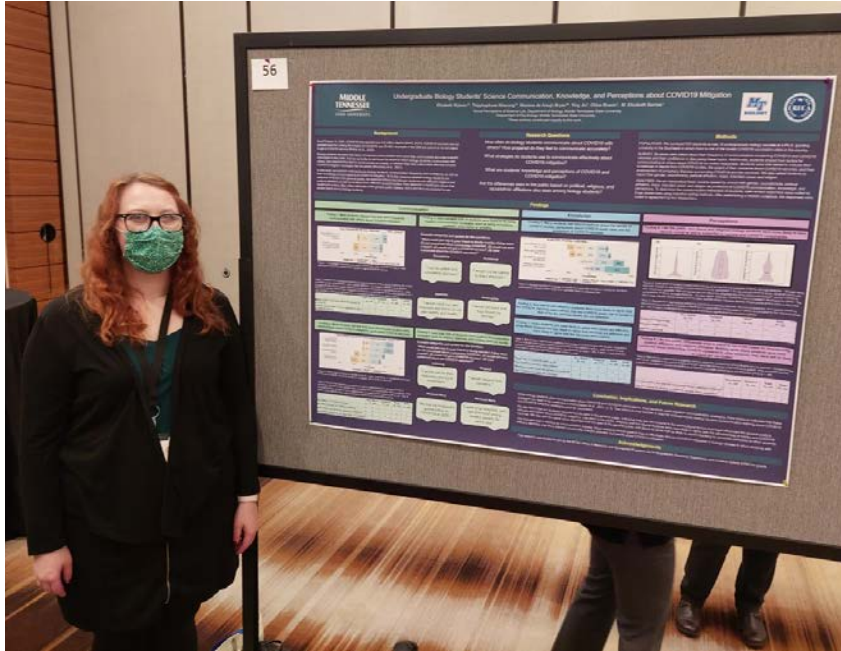


NABT is the leader in life science education and supports teachers, students, scientists, and professional organizations in improving biological literacy. Their conference took place November 11th through the 14th in Atlanta, Georgia.

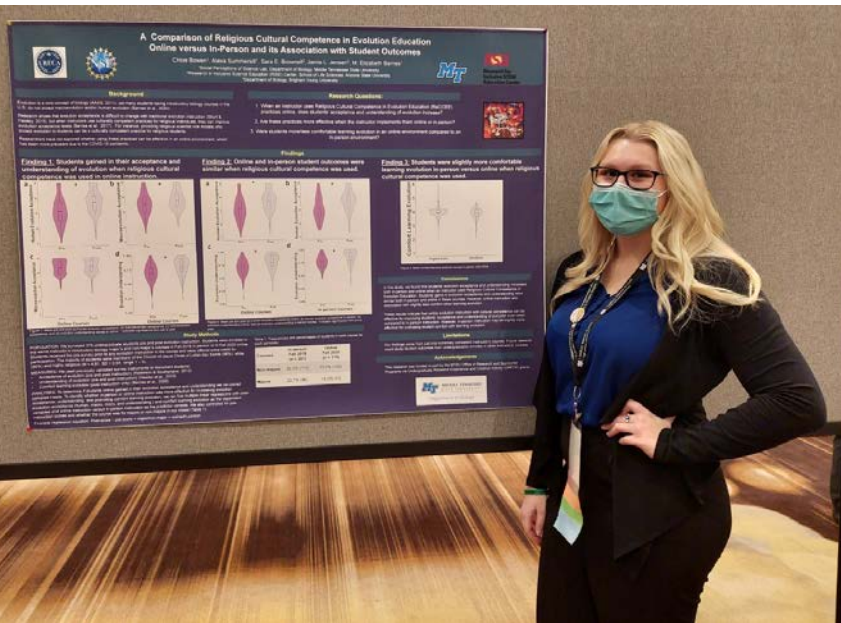
Laine Wybren and Alexa Summersill took home awards in the poster competition for mentored undergraduate research at the NABT Professional Development Conference.

In addition, their mentor, Dr. Elizabeth Barnes, was awarded the Evolution Education Award. This award recognizes those who use innovative classroom teaching methods or community education methods to promote an accurate understanding of biological evolution.

Student Conference Spotlight



Laine Wybren took home second place in the Mentored Undergraduate Research section of the poster session with her project, "Undergraduate Biology Students' Science Communication, Knowledge, and Perceptions about COVID19 Mitigation." Laine is also a two-time URECA award recipient, with one Gold URECA for the Summer of 2021 and one Silver URECA from the Fall of 2021.



Alexa Summersill took home first place in the poster competition for Mentored Undergraduate Research with the project, "A Comparison of Religious Cultural Competence in Evolution Education Online versus In-Person and its Association with Student Outcomes." Alexa also received a Gold URECA Award in the Summer of 2021.

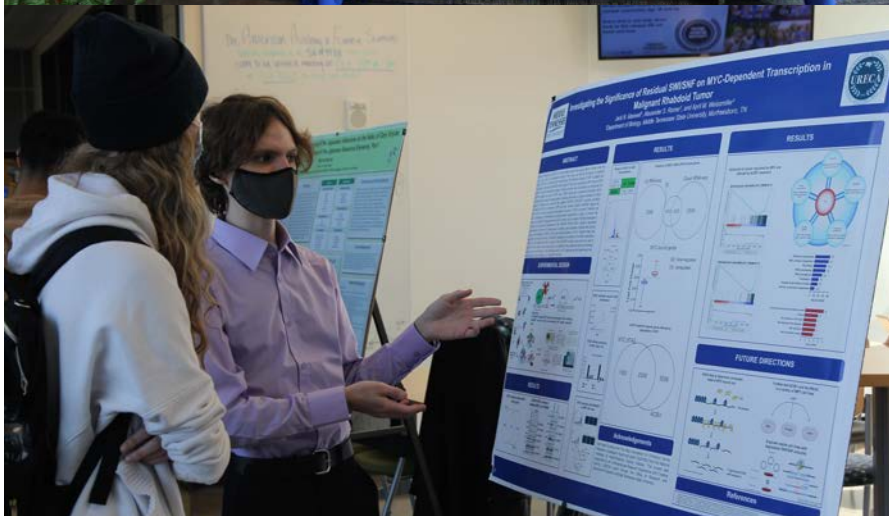
Join us!

WANT TO LEARN MORE ABOUT SOAR?

Check out our [website](#) and current [SOAR student profiles](#)!

A Successful Fall Open House

We wanted to thank everyone who participated in our Fall Open House. We had 29 excellent presenters from a wide variety of disciplines. We also had many wonderful volunteers and attendees. It was a successful event thanks to you! Both students and faculty members were able to view our showcase of diverse projects, from STEM research to projects in sociology, art, journalism, agriculture, and more.



HEALTH SCIENCE MAJORS

We need your help!

Do you have 20 minutes to spare for a fellow undergraduate researcher? Zachary Sanchez, a MTSU Nursing student, is studying beliefs, attitudes, and perceptions of health science undergraduate students related to working with older adults. His research team is in the process of testing and validating a new scale that they have created (Beliefs and Attitudes Toward Working with Older Adults; Sanchez, Moore, and Flagg). There are approximately 40 scale questions and some demographic questions. We would so appreciate your participation. To access the survey, please click [HERE](#).

THANK YOU!!



DID YOU KNOW?

The URC has a facebook page!

Follow us :
Undergraduate Research Center
at MTSU or click the facebook icon
for updates and stories.



STUDENT SHOUT-OUTS!

Biliquis Bintinlaiye won first place for his poster on Raman analysis of dyes in the Tennessee Academy of Science Chemistry poster presentation!

Daniel Bond's abstract for his presentation on Optimal Impulse Control of the West-Nile Virus was accepted to the Emerging Researchers National Conference in STEM, and he earned a travel award!

Davonte Lewis won the Nadine Barlow Undergraduate Research Support Award from the Council on Undergraduate Research!

Several SOAR students defended their Honors College Thesis this semester, including: Alison Blanton, Sarah Garris, Rachel Booher, Ashton Bazzell, Jared Frazier, Miquellie Bonner, Dara Zwemer, and Maria Clark!

HAVE YOU BEEN AWARDED FOR YOUR RESEARCH? CONGRATULATIONS!

Please forward award emails to Dr. Jamie Burriss or Ms. Casey Penston and let us know about your accomplishments so that we can highlight them here!

Jamie.Burriss@mtsu.edu
Phone: 615.494.7669

Casey.Penston@mtsu.edu
Phone: 615.904.8398



What is the Student Organization for the Advancement of Research? AKA "SOAR"



A new student organization comprised of undergraduate students who are committed to developing and sustaining an active and successful undergraduate research environment at MTSU.

SOAR's Mission

To enhance student's research capacity through increased awareness, collaboration and skill building.

Why Join?

- SOAR will enhance a student's research capacity through increased awareness, collaboration and skill building by offering workshops and trainings to fulfill the needs of undergraduate researchers.
- SOAR will assist students in the preparation of poster presentations and development of abstracts to increase conference presence on a national level, encourage students to attend the National Conference on Undergraduate Research, and facilitate travel preparations.
- SOAR will provide peer mentoring to students new to undergraduate research.



FEATURED SOAR STUDENT



ASHTON BAZZELL

Major: Animal Science and General Science

Faculty Mentor: Dr. Jessica Carter

Current Research Focus: Environmental Temperature Effects on Milk Production and Daily Activity of Dairy Cattle with Respect to Different Breeds

Project Description: In January 2021, I began my research with our cows at the MTSU dairy. This research stemmed over three seasons - Winter, Spring, and Summer - to determine if the increase in environmental temperatures negatively effects the daily amount of milk that a dairy cow produces. I have gathered 6 weeks worth of data in each of these three season including air temperatures and relative humidities and the temperature of the bedding that the cows lay on. I have also collected the cow data for each day that shows how much milk each cow produces as well as how much daily activity each cow exhibits. We are in the process of analyzing this data to determine if there is a specific temperature that allows the cows to produce the maximum amount of milk on a daily basis.

Why does this topic interest you?

This topic interests me because there is not a lot of data regarding how temperatures directly affect the milk production of a dairy cow. There is some research to show that cows prefer a temperature range of 40-60 degrees Fahrenheit, but I would like to find a more specific temperature to allow our cows to produce at a higher capacity. If our cows at the MTSU are more comfortable with the temperature of their environment, then they are more likely to produce more milk each day.



What are your professional aspirations?
After finishing undergrad, I aspire to be a veterinarian. I am in the process of applying to veterinary school. I would like to become either a small animal or mixed animal veterinarian, since I have worked with both companion animal and large animal species. I have enjoyed my time in the veterinary field, and I truly hope that I can continue in the field in the future.

Do you have any advice for future researchers?

My advice would be to start speaking with and building connections with your professors early. If you have an idea for a possible research topic, don't be afraid to talk to someone. The relationships that you build with your professors are going to be ones that you will use your entire time through undergrad and even after! Even if your professor isn't the right person to help you with your research, that professor will help you find the correct person for the job. Coming up with a research topic can be a long and strenuous process, so be patient! Trust yourself and your professors and be proud of yourself for taking the plunge into Undergraduate Research!

Distinguished Lecture: We Want YOUR Input!



Who would you like to see featured our Spring URECA Luncheon?

Please [CLICK HERE](#) to fill out a survey!

Alternatively, email Dr. Jamie Burriss at jamie.burriss@mtsu.edu

Lecture Mission

The Distinguished Lecture Committee seeks to promote appearances by nationally and internationally known speakers who focus on the timely discussion of regional, national, and global issues in a variety of fields. The programs sponsored will represent a balance of topics pertinent to the student population of MTSU, and should be designed to elevate the campus dialogue on important current events. Speakers may include authors, lecturers, politicians, and other relevant individuals.

Prior Guests:

Robert "Hoot" Gibson, NASA Astronaut, 2018

Ketch Secor, Musician and Author, 2020

Tell Us About Your Publication!

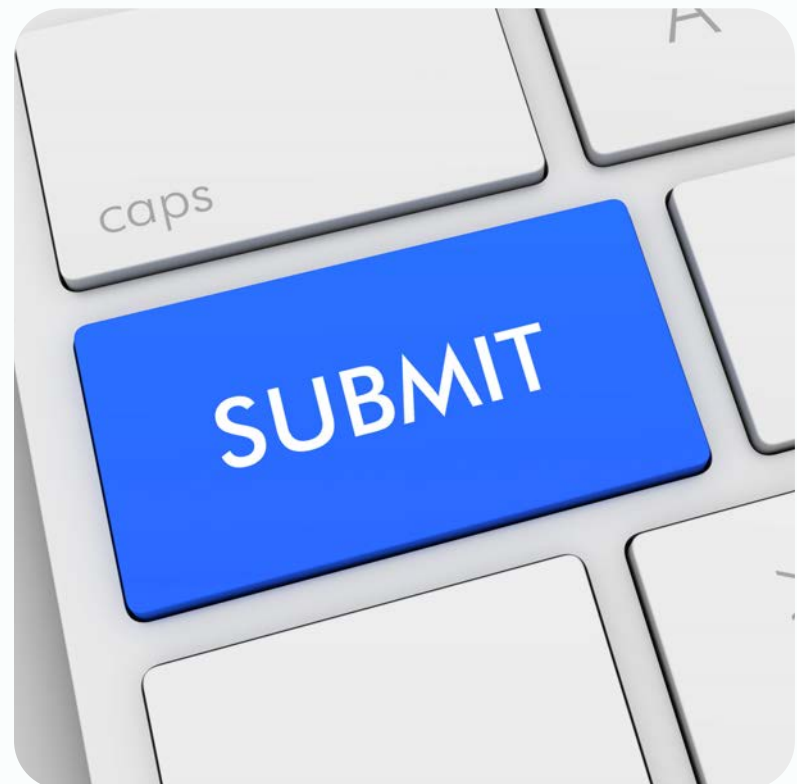
Have you recently published your research?

Get the recognition you deserve!

[CLICK HERE](#)

To Submit Your Work!

Publications will be featured on the Undergraduate Research Center's website! View our students' prior publications by [clicking here](#).



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 in the upper right corner)

CONGRATS TO OUR DECEMBER GRADUATES

We are so proud of you and all that you have accomplished during your time at MTSU! You will be sincerely missed, but we know you will be successful in the adventures that lie ahead.

Distinction in Undergraduate Research

Christopher Hall

Robert Conner

Esmeralda Ramirez

Scholar Distinction in Undergraduate Research

Zachary Sanchez

Ha Bui

Hannah Hudson

Ashton Bazzell

Kylie Moe

INTERNSHIPS & RESEARCH OPPORTUNITIES

Check out the following opportunities for fall research !

- **Various internships, US Environmental Protection Agency | Summer and fall deadlines**
- **Visiting Scientist Program, Counterterrorism, and Forensic Science Research Unit, FBI | Applications reviewed on a rolling basis**

Virtual UR Presentation & Paper Opps

- **Call for Papers, Education in the Age of Misinformation | Deadline December 15, 2021**
- **Call for Submissions, Second Railroads in Native America Gathering and Symposium | Deadline December 15, 2021**
- **Call for Abstracts, APS April Meeting | Deadline December 20, 2021**
- **Call for Abstracts, AEESP 2022 Research and Education Conference | Deadline January 14, 2021**
- **Call for Proposals, 2022 APSA Annual Meeting | Deadline January 18, 2022**
- **Call for Papers, Sigma Xi Society Re-envisioning STEM Education and Workforce Development for the 21st Century | Deadline January 23, 2021**
- **Call for Papers, Environmental Science and Technology | Deadline January 31, 2022**
- **Call for Papers, *The Reed Undergraduate Journal of Existentialism*, St. Olaf College | Deadline January 31, 2022**
- **Call for Papers, 2022 Virtual International Conference on Social Media and Society | Deadline January 31, 2022**
- **Call for Abstracts, 2022 Population, Evolutionary, and Quantitative Genetics Conference | Deadline February 3, 2022**
- **Call for Submissions, JOSHUA: Journal of Science and Health, University of Alabama | Deadline February 28, 2022**
- **Call for Papers, Young Journal of European Affairs, Ludwig-Maximilians-Universität Munich | Submissions accepted on a rolling basis**



National Science Foundation Opportunities

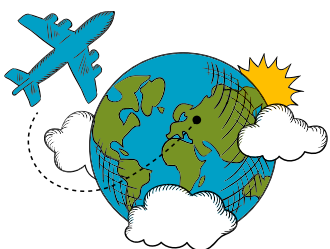
- **Archaeology and Archaeometry** | Deadline December 1, 2021
- **Cyberinfrastructure for Sustained Scientific Innovation (CSSI)** | Deadline December 8, 2021
- **Biological Oceanography** | Deadline December 31, 2021
- **Partnerships for Research and Education in Physics (for minority-serving institutions)** | Deadline January 21, 2022
- **Community Facility Support: Synchrotron-Based Analytical Capabilities Advancing Earth and Environmental Sciences Research and Training** | Deadline March 4, 2022
- **Dear Colleague Letter, Opportunities for Collaboration between CISE and SBE Researchers**
- **Computational and Data-Enabled Science and Engineering** | Various fall deadlines
- **Tribal Colleges and Universities Program** | Various deadlines
- **Dear Colleague Letter, Advancing Discovery with AI-Powered Tools (ADAPT) in the Mathematical and Physical Sciences**
- **Dear Colleague Letter, Envisioning the Future of NSF EBSCoR (Established Program to Stimulate Competitive Research)**



National Institutes of Health Opportunities

- **Listening sessions cohosted by NIH and the White House Office of Science and Technology Policy on the proposed Advanced Research Projects Agency for Health that will seek to speed health research. Search Upcoming Dates and Times.**

STUDENTS! Are you presenting at a virtual or on-ground conference, and would you like assistance in paying for your travel? The URC can help!



The Undergraduate Research Center strives to support students in dissemination of their research. Undergraduates who are accepted to present their research at a regional, state, national, or international conference are eligible to receive financial assistance for registration fees.

Awarded travel funds are payable on a reimbursable basis only.

Please contact Casey.Penston@mtsu.edu for more information.