UNDERGRADUATE RESEARCH CENTER

MIDDLE TENNESSEE STATE UNIVERSITY

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SCHOLARS WEEK 2021

Scholars Week 2021 will take place from April 12-16 and will showcase a variety of in-person and virtual 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 University-Wide Research and Creative Activity Exposition will include a live poster session on Friday, April 16, in the Student Union, Ballroom C. Presenter and attendee spaces will be limited to adhere to COVID-19 restrictions. The schedule for poster presentations and creative performances can be found on page 2.

We will also host a virtual poster session from April 12-23, 2021, via Symposium.

Thank you to all the students and faculty mentors who submitted abstracts to present at the 2021 event!

Be sure to check out the college events on pages 2 & 3 We hope you will join us!

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.

SCHOLARS WEEK 2021

College of Liberal Arts

WEDNESDAY, APRIL 14, 2021

11:30-5:00 pm

Students and faculty are invited to join us for CLA Scholars Day 2021!

Details including abstracts and Zoom registration available HERE.

11:30 a.m. /Student and Faculty Panel

12:00 p.m. /Student and Faculty Individual Research Presentations

12:40 p.m./MTSU Arts Projects: Faculty and Student Performances

1:00 p.m./Break

1:30 p.m./Studying Religion Virtually Panel

2:00 p.m./WGST Faculty Research Panel

2:30 p.m./WGST Student Research Panel

3:00-5:00 p.m./*Inspired by Goldilocks: Staged Readings of Short Scenes*

4:00 p.m./Annual MTSU Speech Contest *(YouTube release)*

College of Media and Entertainment

WEDNESDAY, APRIL 14, 2021

2:00 pm

Wall of Fame & Student Awards Ceremony

Streamed on https://www.facebook.com/MediaCollegeMT

FRIDAY, APRIL 16, 2021

2:00 pm

Old-Time Music in the 21st Century Unconference

The MTSU Center for Popular Music presents the third and final event in its series of open discussions about old-time music today, with featured panelists and a remote meeting format that encourages audience input.

The topic for this event is Sustainability and Community.

Hosts: Greg Reish (Director, MTSU Center for Popular Music)

Dan Margolies (Professor of History, Virginia Wesleyan University)

Zoom registration link will be posted here:
https://www.facebook.com/center4popmusic

College of Basic and Applied Sciences

CBAS Virtual Poster Competition during **Scholars Week 2021 via Symposium**
Posters will be judged and prizes awarded at three levels: undergraduate, masters, and doctoral.
Please join us in showcasing and celebrating the research projects taking place in our college.

Friday, April 16, 2021
2:30pm

Meet with Dr. Williams to discuss internship opportunities at NASA!

KEYNOTE SCHOLAR'S DAY SPEAKER
Dr. Elissa H. Williams

National Aeronautics and Space Administration
Greenbelt, MD USA
Friday, April 16th, 2021 at 2:30 PM
2:30-3:10 PM Q&A session hosted by MTSU Chemistry Society

Join Us on Zoom!
https://mtsu.zoom.us/j/81003041964?pwd=d2dvRlRGbzYrZGQvNGVNaTdqYkVYdz09
Meeting ID: 810 0304 1964
Passcode: 371979

(Note: Dr. Williams' talk will be given using a different Zoom link provided with the abstract of her presentation.)

University Wide
Poster and Creative Activity Exposition
Friday, April 16, 2021
Student Union Ballroom

Schedule of Events

10:00-10:45AM/POSTER PRESENTATIONS: ROUND 1

11:00-11:15AM/CREATIVE PERFORMANCE: THEATRE-STORY BANDITS

11:15-12:00PM/POSTER PRESENTATIONS: ROUND 2

12:15-12:30PM/CREATIVE PERFORMANCE: SINGER/SONGWRITERS

12:30-1:15PM/POSTER PRESENTATIONS: ROUND 3

1:30-1:50PM/CREATIVE PERFORMANCE: THEATRE-GODSPELL

1:50-2:15PM/CREATIVE PERFORMANCE: MUSIC

2:15-2:30PM/CREATIVE PERFORMANCE: DANCE SOLOS

2:30PM/AWARDS CEREMONY VIA LIVE STREAM
PRESENTED BY DR. DAVID BUTLER, VICE PROVOST FOR RESEARCH

save the date

2ND ANNUAL URECA LUNCHEON

FEATURING KETCH SECOR OF OLD CROW MEDICINE SHOW - DISTINGUISHED LECTURE -

UNDERGRADUATE RESEARCH WEEK

20 APRIL 2021 • 11:00AM
KUC THEATER

Sponsored by
MTSU's Distinguished Lecture Fund
and the
Student Organization for the Advancement of Research

The URC is excited to welcome Ketch Secor to MTSU as the distinguished lecturer for our 2nd Annual URECA luncheon.

For the last twenty years, multi-instrumentalist **Ketch Secor** has been front man and fiddler for **Old Crow Medicine Show**. Described variously as alt-country, folk, and mountain music revivalists, Old Crow is an American roots string band with punk rock attitude and energy.

Born Jay Ketcham Miller Secor, Ketch attended New Hampshire's prestigious **Phillips Exeter Academy** on scholarship. There, he learned to play banjo and fell in love with Bob Dylan. One of the Dylan songs Ketch discovered was a snippet entitled "Rock Me Mama," an outtake from a 1973 Dylan recording session in Burbank, California. Homesick for Virginia, Ketch expanded upon the song, adding verses about long New England winters and hitchhiking south. That song, **later co-copyrighted with Dylan, became "Wagon Wheel" – Old Crow's signature song**, released in 2004, and a No. 1 country hit for Darius Rucker in 2013.

Old Crow Medicine Show became members of the **Grand Ole Opry** on September 17, 2013. That same year, they received the Trailblazer Award from the Americana Music Association and, two years later, won the **2015 GRAMMY Award for Best Folk Album** with their LP, Remedy. Known for his interest in Appalachian history and musicology, Ketch recently wrote a **children's book, *Lorraine*** – his retelling of a Southern folktale, interwoven with the power of music.

Ketch is also heavily featured in **Ken Burns' documentary *Country Music*.**

Tickets for this event will be limited to comply with COVID-19 restrictions. The event will also be live streamed to the MTSU Community. Students and Faculty in attendance will be provided with a meal voucher to get lunch in the SUB after the event.

REGISTER HERE

FEATURED SOAR STUDENT

ZACHARY SANCHEZ

Major: Nursing

Faculty Mentor (s): Dr. Shelley Moore, Dr. Amanda Flagg

Current Research Focus: Beliefs, Attitudes, and Opinions of Nursing Students on Working with Older Adults

Project Description: My research is focused on nursing students attitudes, beliefs, and opinions of nursing students in relation to caring for geriatric patients. Specifically measuring said attitudes, beliefs, and opinions in hopes of finding interventions to make nursing students more likely to choose geriatric care as their specialty, given the current severe lack of geriatric caregivers.

Why does this topic interest you?
I've always loved science and medicine, and when Dr. Moore suggested this project I jumped on the opportunity. We all know older adults, we are all going to be Older Adults at some point most likely, so it is critical that not only today's older adults are being cared for but that tomorrow's older adults are also being cared for, in hopes that when my generation is older, we can live out the remainder of our years with at least a decent quality of life.

What are your professional aspirations?
I wish to pursue graduate school to further my scope and knowledge of research, and pursue it as my career.

Do you have any advice for future researchers?
It takes a lot of determination, and being willing to not only step out of your comfort zone but live in it for a while, but it's really worth it. Through the handful of projects I've gotten to complete, I've found my future career.

Join us!

WANT TO LEARN MORE ABOUT SOAR?

Check out our website and current SOAR student profiles!

INTERNSHIPS & RESEARCH OPPORTUNITIES

Check out the following opportunities for summer research !

- **Curatorial Assistant and Digitization Internship, Antique Boat Museum | Deadline April 16, 2021**
- **2021 Summer Internships, Transportation Security Laboratory, US Dept. of Homeland Security | No application deadline listed.**
- **REU, Marine Biological Laboratory, University of Chicago | No application deadline listed.**
- **Summer 2021 Donald P. Gallop Neighborhood Image Mapping Project Intern, Missouri Historical Society | Deadline April 30, 2021**
- **REU in Advanced Secured Sensor Enabling Technologies, Florida International University | Deadline May 10, 2021**

Virtual UR Presentation & Paper Opps

- **Call for Abstracts, 2021 Joint Virtual Meeting, American Ornithological Society/Society of Canadian Ornithologists | Deadline April 15, 2021 (offers student presentation awards)**
- **Call for Abstracts, "Converging Crises: Transgender Health, Rights, and Activism in 2021," Transgender Professional Assn for Transgender Health Conference | Deadline April 15, 2021**
- **Call for Submissions, Undergraduate Research journal, Georgia College & State University | Deadline May 1, 2021**
- **Call for Abstracts, Virtual 2021 Annual Conference, The Wildlife Society | Deadline May 14, 2021**
- **Raymond J. Cunningham Prize, American Historical Assn (for the best article published in a journal written by an undergraduate student) | Deadline May 15, 2021**
- **Call for Papers, "Special Forum: Undergraduate Perspectives on Feminism"; Journal of Feminist Scholarship | Deadline May 15, 2021**
- **Call for Papers, Afkar: The Undergraduate Journal of Middle East Studies | Deadline June 1, 2021**
- **Twenty-First Annual Steel Design Student Competition, Association of Collegiate Schools of Architecture | Deadline June 2, 2021**
- **Call for Papers, Cura Terra: Georgetown's Undergraduate Journal of the Environment | Submissions accepted on a rolling basis**

STUDENTS! Are you presenting at a virtual conference this spring and would like assistance in paying for your registration fee?
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 Wendi.Watts@mtsu.edu for more information.

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)**

****Deadline to submit application: April 30th**

DISTINCTION CRITERIA

Distinction in Undergraduate Research
*Students must fulfill all requirements

1. Successful completion of an Assistant level URECA project - 50 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.
3. Active participation for at least one academic year in the Student Organization for the Advancement of Research (SOAR).
4. Letter of support from URECA faculty mentor.

Scholar Distinction in Undergraduate Research
*Students must fulfill all requirements

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.
3. Active participation for at least one academic year in the Student Organization for the Advancement of Research (SOAR).
4. Poster or presentation at the National Conference on Undergraduate Research or published in a peer-reviewed academic journal.
5. Letter of support from URECA faculty mentor.

The application can be accessed HERE.

National Conference on Undergraduate Research
2021@home
MTSU Presenters

George Boktor

Mentor: Dr. Hanna Terletska, Department of Physics and Astronomy

Abstract Title: Disorder-induced metal-insulator transitions: a quantum cluster study

Abstract: Disorder, in the form of impurities and defects, is a common feature of modern quantum materials. In fact, disorder, can be used to change the properties of modern materials. For example, disorder-induced Anderson localization, can control the conducting properties of a system. I.e., by changing the amount of impurities in the material, one can turn the conductor into an insulator. In our research, we have conducted a systematic numerical study of how to study such electron localization and the metal-insulator transition in a three-dimensional Anderson model for two different kinds of disorder, the box, and binary disorder. We have used the quantum cluster typical medium theory to determine the critical values of disorder needed to make the phase transition to occur.

Miquellie Bonner

Mentors: Dr. Mengliang Zhang, Dr. Ngee Chong, Department of Chemistry

Abstract Title: Novel Method for the Forensic Dye Analysis by Direct Analysis in Real Time Mass Spectrometry

Abstract: Direct Analysis in Real Time Ionization Source coupled with Mass Spectrometry (TD-DART-MS) has been used to identify the polymeric backbone structures of different textile materials such as cotton, nylon, polyester, cellulose triacetate, poly(propylene) and poly(acrylonitrile) in our lab. This analysis is very important to forensic trace analysis as examiners should perform a combination of methods to characterize fiber evidence, along with providing a complete and specific description of an item, rigorously assessing its uniqueness, and value as evidence. While methods such as Liquid chromatography-mass spectrometry (LC-MS) are currently applied, it can be laborious and time-consuming (e.g., about 1 hour). This study will propose and evaluate the unique TD-DART-MS method for the analysis of specifically dyes on differing fibers, which differs from past studies on fibers using TD-DART-MS. There are thousands of textile dyes which are often classified into different categories according to their application method and their chemical composition. This study will focus on the blue dyes from four categories including acid, basic, reactive, and vat blues which are commonly used in manufactured textiles and are more likely to have forensic value. Dye standards will be analyzed through TD-DART-MS and the characteristic ions will be identified. Fabric sheets, each dyed with an individual blue dye, will also be analyzed and compared to the standard and the method will be compared and validated by a standard Raman microscopic method. The expected results will show characteristic ions in the dyed fiber spectra that are consistent with the dye standards. The information collected will be useful to the study of fiber evidence in forensic science as the TD-DART-MS is not only a faster method, but can be a stand-alone method to provide a multidimensional chemical profile of textile fiber evidence.

Meredeth Bryson

Mentor: Dr. Mark Abolins, Geosciences Department

Abstract Title: Horizontal Positional Accuracy Assessment of 7.5' Digital Geologic Maps of Part of the Nashville Dome, Central Tennessee

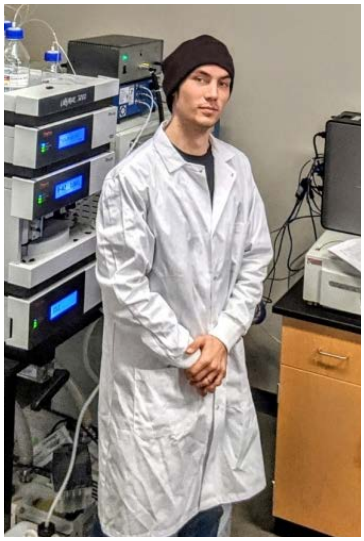
Abstract: I seek to better-understand the horizontal positional accuracy of 7.5' digital geologic maps in general. For example, it has been asserted that the positional accuracy of well-located contacts on some digital 7.5' geologic maps exceeds 15 m. In this project, I quantitatively assessed the horizontal positional accuracy of digital geologic maps. To accomplish this, I began by georeferencing 48 published 7.5' quadrangle geologic maps of Central Tennessee using the ArcGIS program. I was provided with scanned geologic maps. For each scanned map, I matched 10 marked intersections of latitude and longitude with the corresponding points on a USGS 7.5.' digital raster graphic (DRG). I then applied an affine transformation to the scanned geologic map. The mean RMS horizontal positional error was 5.5 m, with a range of 3.1-9.4 m. This could be due to distortions in the scanned maps, and it could be due to human error in assigning matching points. Results will be used in ongoing efforts to quantify uncertainties in the estimated thicknesses of Central Tennessee sedimentary rock formations. The larger research goal is to understand the origin of thickness variations in carbonate strata deposited during Late Ordovician (~453 Ma) tectonic uplift of the Nashville Dome.

Shelby Cox

Mentor: Dr. John DuBois, Department of Biology

Abstract Title: Assessment of Cannabinoid Levels in Successively Cloned Generations of Industrial Hemp (Cannabis sativa)

Abstract: The business of industrial hemp (Cannabis sativa) has grown tremendously over the past decades, both in agriculture and pharmaceuticals because of its potential health benefits. Plant propagation using stem cuttings from stock plants has become the favorite method of growing hemp for farmers (Caplan et al. 2018). Recent studies have shown that plant propagation can lead to certain genetic changes known as somaclonal variations. This research was designed to test the effects of cloning hemp varieties (Cherry, Cherry Blossom, and Cherry x Workhorse) through plant propagation on cannabinoid production. Results showed significant differences in cannabinoid levels between clonal generations of each variety. The results of this study could be useful to farmers and hemp research centers such as the Tennessee Center for Botanical Medicine Research, and other hemp agricultural departments that must maintain cannabinoid consistency standards.



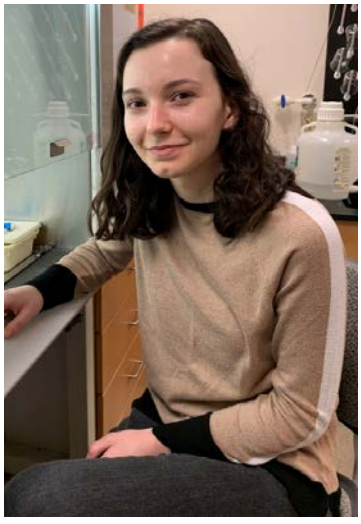
Jared Frazier

Mentor: Dr. David Butler, Vice Provost for Research

Abstract Title: Blue Mars Initiative: Developing Linear Regression and Artificial Neural Network Models to Forecast Mesoscale Martian Weather Conditions

Abstract: At any given moment, a devastating cosmic event could wipe all life on Earth from existence. In combination with pressures humanity places on Earth's biosphere, extinction may be inevitable.1 Going beyond our domain, further from the sun, and to the terrestrial planet Mars may be one way to reduce the possibility of human extinction. Despite this lofty goal, the hostile Martian weather conditions differ vastly from those on Earth, and the ability to predict t hose conditions would be invaluable for successful colonization. In particular, the extremely wide range of temperatures (20°C to -73°C) are a significant barrier to implementing human infrastructure.1 Traditional weather prediction techniques implemented on Earth such as numerical weather prediction (NWP) are extremely computationally intensive and are not always stable due to the volatile physical conditions of the Earth's atmosphere. Additionally, NWP can not be easily transferred to predicting Martian weather.2,3 To overcome this barrier, supervised machine learning—a method that is resistant to the incomplete understanding of atmospheric conditions that introduces uncertainties to NWP—is ideal for the even less understood Martian atmosphere.4 Weather data for Mars' Gale Crater was collected by NASA's Curiosity Rover and is available through their Planetary Data System. Two types of machine learning algorithms will be implemented for the prediction of mean temperature using Curiosity's data: linear regression and artificial neural networks. These machine learning paradigms were selected due to the ability of each to account for the mix of non-linear and linear responses in weather.5-7 For both models, ~3 Martian years of weather data will be used to predict ~1 year of test data. The mean and median absolute error for the prediction of mean temperature will be calculated and the models will be compared.

Jewel Galloway



Mentor: Dr. Stephen Wright, Department of Biology

Abstract Title: Evaluation of Physiological Traits Expressed in vitro and Effects on Plant Growth by Bacillus Endophytes

Abstract: Bacillus species are an important group of rhizobacteria that have been shown to enhance the growth of plants and protect against diseases caused by plant pathogens. This study investigated the mechanisms used by B. atrophaeus and B. thuringiensis to promote plant growth and explored their potential as biofertilizers and biocontrol agents for application in agriculture. Effects of each bacterial strain on the growth of Brassica rapa were evaluated under greenhouse conditions with sterile soil. Plant growth promotion traits including nitrogen fixation, phosphate solubilization, and siderophore production were assessed using in vitro microbiological techniques. Additionally, in vitro methods were used to evaluate antagonistic activities against two soil-borne pathogens, Fusarium oxysporum and Agrobacterium tumefaciens. To verify nitrogen fixation activity, the nitrogenase gene, nifH, was amplified by PCR. Plants inoculated with B. atrophaeus had significantly greater biomass and increased length compared to the control. In the in vitro assays, B. atrophaeus exhibited antimicrobial and nitrogen fixation activity while B. thuringiensis was positive for siderophore production. These bacteria could potentially be used as biofertilizers and biocontrol agents in conjunction with currently used agrochemicals to reduce the environmental costs associated with synthetic chemicals.

Koda Hengstenberg

Mentor: Dr. Scott Handy, Department of Chemistry

Abstract Title: Exploration of Aurone System in Mercury Sensing

Abstract: Mercury remains one of the most toxic heavy metal pollutants today. Mercury finds its way into ecosystems through air, water, soil and many natural processes. For this reason, it is necessary in identifying mercury at a microscopic level; fast, reliable and safe techniques are vital for early detection. Some of the many symptoms from mercury poisoning include, loss of neurons with reactive proliferation of glial cells, microvacation, vascular congestion petechial hemorrhage and edema. With the effects ultimately leading to death, it is fundamental that detection is prioritized. In particular to aurones, they offer fast and predictable results while also negating the use of harmful UV-light because of the high photostabilities. It has been concluded that the aurone base could provide a source of a reactive alkene, capable of an oxymercuration reaction necessary in detection. Reacting with an alkene to form a cyclic mercury compound, the UV/Fluorescence properties are hypothesized to change, ultimately providing for an "ON-OFF" switch. The 4hydroxyallylaurone showed great results when reacting with mercury in an aqueous environment. Shifts in fluorescence intensity provided an "ON-OFF" switch, but modifications to overall structure could increase the disparity in fluorescence intensity after mercuration.. Enhancing the specificity and sensitivity of the reaction with respect to fluorescence will create a simple detector molecule capable of detecting mercury ions present in concentrations lower than those deemed toxic by the USA Environmental Protection Agency (EPA) in safe drinking water (2.0 ppb).

Jori Graeff

Mentor: Dr. Jeffrey Leblond, Department of Biology

Abstract Title: Sterol Composition of the Peridinioid Dinoflagellate Zooxanthella nutricula, a Symbiont of Polycystine Radiolarians: Implications for Symbiont-Derived Radiolarian Sterols and a Comparison to Sterols of other Dinophyceae

Abstract: Some dinoflagellates, such as Symbiodinium, are able to form symbiotic relationships with larger marine organisms. An important aspect of dinoflagellate symbiosis involves the exchange of lipids, namely sterols, from the symbiont to the host. Much research has explored the lipid biochemistry of the symbiotic relationship between cnidarians and Symbiodinium dinoflagellates. However, no research has addressed the sterol biochemistry of the symbiosis between radiolarians and dinoflagellates such as Zooxanthella nutricula. To this end, we have provided the first sterol characterization of Z. nutricula isolated from a spumellarian polycystine radiolarian. Lipids were extracted from cell cultures using a chloroform, methanol, and phosphate buffer system. Collected lipids were fractionated into component lipid classes using open column chromatography and solvents of varying polarity. Collected free and esterified sterols were saponified and derivatized to form trimethylsilyl ethers, and resulting sterol derivatives were analyzed using gas chromatography/mass spectrometry (GC/MS) with positive-ion electron impact (EI) ionization. Fifteen sterols and one steroidal ketone were observed where the major sterol identified was C27 22-dehydrocholesterol (comprising approximately 30% of the sterols), which does not tend to be a dominant sterol among dinoflagellates, including closely related peridinioid species in the genus Heterocapsa. However, in Z. nutricula, C30 dinosterol comprised about 20% of the sterols and C30 dinostanol comprised about 8% of the sterols. These sterols were identified with similar abundances in both Z. nutricula and Heterocapsa spp., thus indicating common sterols between closely related taxa. Major sterols of the distantly related genus Symbiodinium, a symbiont of foraminifera and cnidarians, have included C27 cholesterol and C30 gorgosterol, whereas in Z. nutricula these sterols were minor and absent, respectively. Our results indicate potentially different sterol pools available to cnidarian and radiolarian symbiont hosts during their respective relationships with symbiotic dinoflagellates.

Yostina Lamei

Mentor: Dr. Tiffany D. Rogers, Department of Psychology

Abstract Title: Effects of Dopamine Agonist and Antagonist on Social Behavior in Mice

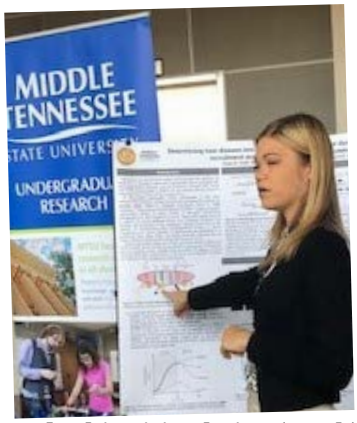
Abstract: Dopamine (DA), a neurotransmitter, plays a role in motivation, learning, mating, and aggression in humans. The present study experimentally investigates the effects of DA agonist and antagonist on social behavior in male and female C57BL/6J mice. Subjects (N=60), aged 8-10 weeks, were randomly assigned to undergo DA agonist, antagonist, or saline intraperitoneal (i.p.) injections before being assigned to a social motivation task or a T-maze. Hand coding will be used for the social motivation task to record the following: time spent in the incentive zone (within 10 cm of the cage), time spent in the social approach of the subject to the stimulus mouse, time spent in avoidance of the stimulus mouse, number of times the incentive mouse rears, indicating anxiety. Hand coding will also be used in the Tmaze to record the following: time spent in a nose to nose orientation, time spent in the social approach of the experimental mouse to the stimulus mouse, time spent in avoidance of the stimulus mouse, number of times experimental mouse bites, indicating aggression. Aggression is expected to be found in male mice treated with DA agonist and female mice pretreated with DA antagonist. Non-competitive social behavior is expected to be facilitated in male mice pretreated with DA antagonist and in female mice with DA agonist. Implications of these findings are discussed relative to DA's role as an interacting factor with oxytocin.

Kylie Moe and Ashton Reece

Mentor: Dr. Donald Walker, Department of Biology

Abstract Title: The endosymbiotic bacterial community of the causative agent of white-nose syndrome (Pseudogymnoascus destructans) of bats.

Abstract: Diseases caused by fungal pathogens have contributed to devasting and long-term consequences to wildlife, including extinction and economic impacts. These pathogens are notoriously difficult to control due to molecular and physiological similarities to their eukaryotic hosts. Most treatment options not only affect the fungal pathogen, but also negatively impact the host. Gaining a better understanding of the physiological and biological characteristics of fungal wildlife pathogens can provide a foundation for developing alternatives to traditional treatment applications. Pseudogymnoascus destructans (Pd), the causative agento f white-nose syndrome in bats, is currently threatening bat populations across North America. Our goal of this work was to characterize symbiotic and/or antagonistic biological relationships that Pd fungus might have with bacteria. The DNA from eighteen Pd isolates collected from eighteen tricolored bats (Perimyotis subflavus) was sequenced using two techniques, including Sanger and high-throughput sequencing. The fungal isolates were imaged using transmission and scanning electron microscopy and exhibited bacterial cells inside fungal hyphae. Using DNA sequence data, we identified a bacterial species in the genus Nocardia sp. as a potential endohyphal resident of the fungus. To understand physiological differences between Pd with and without endohyphal bacteria, all isolates were treated with antibiotics to effectively reduce Nocardia sp. abundance. Treatment groups were created using an antibiotic cocktail (treatment) and compared to wildtype isolates that received no antibiotic treatment. We then evaluated protease activity using skim milk agar for both treatment and wildtype groups. Growth rate statistically differed between groups and was higher in wildtype isolates. Currently, our results support the possibility of a symbiotic relationship between Pd and Nocardia sp. These results improve our understanding of the interactions between Pd and the bacteria that inhabit it, and may provide a potential target to counter the virulence of this fungal pathogen.



Gabriella S. Morin

Mentor: Dr. David E. Nelson, Department of Biology

Abstract Title: Determining How the PINK1:Parkin Mitophagy Pathway Responds to Transient Mitochondrial Stress and How This is Affected By Disease Associated Mutations in Parkin

Abstract: Mitophagy is a mitochondria-specific form of autophagy used by cells to remove damaged, dysfunctional mitochondria. The process serves to maintain the health of mitochondrial networks and prevent cell death via the intrinsic apoptotic pathway. The PINK1:Parkin mitophagy pathway is capable of identifying depolarized mitochondria with both proteins accumulating at the surface of these and cooperating to assemble phospho-polyubiquitin chains (ppUb) on outer mitochondrial membrane (OMM) proteins. These ppUb chains serve as docking sites for additional Parkin proteins and autophagy receptors that recruit the autophagic machinery to mitochondria. While previous studies have suggested that this process can be disrupted at its earliest stages by repolarization of the mitochondria, resulting in rapid degradation of PINK1 proteins, more recent work has shown that Parkin proteins are retained at the OMM for more than an hour after mitochondrial membrane potential has been restored. However, the molecular mechanism for this remains unclear. In this thesis, we test the hypothesis that Parkin proteins are retained after mitochondrial association though interaction with OMM ppUb proteins. This was performed by measuring colocalization of EYFP tagged wild type or an E3 ligase-Dead Parkin mutant (C431S) with a red fluorescent mitochondrial marker in cells treated with the mitochondrial depolarizing agent, CCCP, pre- and post-washout by live cell microscopy. Consistent with published data, we find that EYFP-Parkin is retained at mitochondria for at least one-hour post-repolarization. While a smaller fraction of EYFPParkin-C431S proteins were found to associate with mitochondria in CCCP-treated cells, consistent with our hypothesis, these were found to dissociate and return to the cytoplasm rapidly post-CCCP washout, indicating that ppUb has a role in Parkin retention post-mitochondrial repolarization.

Zachary Sanchez

Mentors: Dr. Shelley Moore, Dr. Amanda Flagg School of Nursing

Abstract Title: Beliefs and Attitudes on Working with Older Adults Scale Development

Abstract: The goal of this research project was originally to study why nursing students don't specialize in geriatrics – it is consistently ranked as one of the lowest populated specialties for new grads. The previous literature review indicated the need for new and better-developed scales, therefore this part of the research project was focused on developing a scale we could then use to measure nursing students' attitudes, behaviors, and knowledge concerning working with older adults. As the number of older Americans grows, the lack of healthcare professionals that would work with these individuals has become more and more relevant. Nurses are the best positioned to help fill this void of clinicians as they are the largest group of healthcare professionals and can be educated readily in the care of older adults. After conducting a literature review, many of the articles recommended more longitudinal studies, larger scales, and revision of previous scales. With that information, we developed a 37 question scale using previous scales' questions that we updated or adding brand new questions we made in consultation with various literature. This scale's constructs contained: Control beliefs (factors that individuals perceive as being present that may facilitate or impede the performance of their behavior); Attitudes (the degree to which a person has a favorable or unfavorable evaluation of the behavior of interest. It entails a consideration of the outcomes of performing the behavior); Behavioral beliefs (the subjective probability that the behavior will produce a given outcome or experience); Subjective norms (the belief about whether most people approve or disapprove of the behavior); and Knowledge (which is objective information about caring for older adults).

Luis A. Zuniga

Mentor: Dr. Cole G. Easson, Department of Biology

Abstract Title: Investigating vertical transmission of microbial symbionts in marine sponges

Abstract: Coral reefs present a paradox since these diverse ecosystems exist in oligotrophic environments. This diversity is in part possible because of the efficient recycling of essential nutrients facilitated by resident organisms and their microbiomes. The current study focuses on the sponges of marine coral reefs and their symbiotic microbiomes. Sponges and their symbionts play a role in the recycling of nutrients and help ensure productive energy flow, allowing coral reefs to thrive. Efforts have been made to identify the symbionts in marine sponges through the Earth Microbiome Project. However, it is difficult to tell which microbes are "true" symbionts, meaning they play an integral role in the survival of the sponge and are likely in association with the sponge larvae. We hypothesized that symbionts in these sponges are transferred vertically (adult to offspring), and or horizontally (from surrounding environments). To test this, we took three species of sponges (Iotrochota birotulata, Niphates erecta, Svenzea zeai), adult and larvae, and sequenced the V4 region of their 16S rRNA genes using next-generation Illumina sequencing. This experimental design allows us to observe which microbial taxa are present in both life stages. Our results suggest that symbiont transmission is species specific, which agrees with our current understanding of adult sponge microbiomes. Vertical transmission of some taxa was observed in all species, however only two (I. birotulata, S. zeai), showed significant differences between life stages. These differences suggest that a portion of the sponge's symbionts are acquired horizontally. Conversely, data from N. erecta suggests vertical transmission, with few taxa exhibiting a shift between life stages. While this study only investigates three sponges, it provides important insight into microbial transmission among marine sponges on coral reefs. These insights, though specific to the collected species, help add to the overall knowledge of dynamic processes within marine coral reefs.

Dara Zwemer

Mentor: Dr. John Pennington, Department of Psychology

Abstract Title: Officer Workload and Officer-Involved Shootings of Unarmed Decedents From 2016-2017

Abstract: Two measures of police officer workload in the U.S. were created from archival data and used as potential predictors of the number of lethal officer-involved shootings of unarmed individuals (LOIS-Us) (N = 146) that occurred in 2016 and 2017. To create total crime and violent crime workload indices, the population size, number of employed officers, number of violent crimes, and number of property crimes was obtained for each municipality and state in which a LOIS-Us occurred. The present author hypothesized that states with more LOIS-Us would have higher total and violent crime workload values than states with fewer shootings; the author also predicted that both workload values would be higher in municipalities where shootings occurred, compared to those cities' statelevel workload measures. Unexpectedly, state total crime workload values were unrelated to LOIS-Us, and state violent crime workload values were negatively correlated with LOIS-Us. Similarly, municipalities with LOIS-Us had significantly lower total and violent workload values than the state in which the municipalities were located. These results may stem from officers in locations with lower workloads having less experience than officers in locations with higher workloads. In addition, more officers may respond to a single crime in municipalities with lower violent workload values. Future research that includes more recent cases may allow one to predict which U.S. municipalities may be more at risk for lethal OISs based on their total and violent workload indices.