UNDERGRADUATE STUDENT RESEARCH

Austin Peay State University
East Tennessse State University
Middle Tennessee State University
Tennessee State University
University of Memphis
University of Tennessee-Martin
University of Tennessee-Knoxville

POSTERS AT THE CAPITOL

FEBRUARY 16, 2022

Posters at the Capitol 2022
Cordell Hull Building
425 5th Avenue
Nashville, Tennessee 37243

Goals:

On February 1, 2006, Tennessee joined a dozen other states by exposing state legislators to undergraduate research from across the state through the first-ever Tennessee Posters at the Capitol. Sixty-three undergraduate students from six Tennessee Board of Regents (TBR) universities and three University of Tennessee campuses will present their research through posters at the Tennessee State Capitol in Nashville. Legislators will be encouraged to meet students from their districts and see first-hand the outstanding research being conducted by undergraduates across the state. 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.

Participating Universities

Austin Peay State University (APSU), Dr. Alisa White, President

East Tennessee State University (ETSU), Dr. Brian E. Noland, President

Middle Tennessee State University (MTSU), Dr. Sidney A. McPhee, President

Tennessee State University (TSU), Dr. Glenda Glover, President

University of Memphis (U of M), Dr. M. David Rudd, President

The University of Tennessee, Knoxville (UTK), Dr. Donde Plowman, Chancellor

The University of Tennessee, Martin (UTM), Dr. Keith Carver, Chancellor

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WELCOME *from the* GOVERNOR

Dear Friends,

I am honored to welcome students from all across the University of Tennessee and Board of Regents systems to the Capitol for the annual Posters at the Capitol event.

This event provides a great opportunity for some of our brightest young minds to present their research to lawmakers. By sharing ideas and working together, we can unleash the extraordinary problem-solving potential of Tennessee. I believe education is the key for Tennessee to lead the nation, and I hope your participation in this event is an enriching experience that inspires you to further academic achievement.

Again, welcome to the annual Posters at the Capitol event. Maria and I send our best wishes for a successful event.

Sincerely,

Bill Lee

Bill Lee

THE UNIVERSITY OF TENNESSEE

OFFICE OF THE PRESIDENT

Welcome to Posters at the Capitol:

Research conducted at the University of Tennessee changes lives—from controlling a wheelchair with your mind to preventing blindness with an eye drop. This worthy program offers an opportunity to celebrate students, faculty and staff at the University of Tennessee who are focused on addressing everyday problems with innovative solutions.

The projects on display, presented by undergraduate students, represent significant discovery and achievements. As researchers and scholars, these students ask "why" and figure out "how" in their various disciplines. Students at the University of Tennessee also benefit from access to world-class facilities and expertise as well as UT's partnership with Oak Ridge National Laboratory.

Student discoveries impact how we live, work and understand our world, and I'm proud to share their work with our state's leaders and the public.

Sincerely,

Randy Boyd
Interim President

Welcome from Austin Peay State University

Alisa White, President

Austin Peay State University (APSU) is committed to promoting student research and recognizes that student research initiatives provide a transformative learning experience for students and an opportunity to interest them in pursuing innovative research activities beyond their undergraduate careers. During the Posters at the Capitol event, you will have the opportunity to meet some of Austin Peay's outstanding student researchers and learn about the impressive research projects they completed in collaboration with dedicated and talented faculty members. The APSU Office of Student Research and Innovation (OSRI) is dedicated to working with students and faculty to inform students about research opportunities and funding sources, identify partnerships, and provide opportunities for students to present their completed research. Financial support for students who are conducting and presenting research is provided through collaborations between academic affairs and student affairs in order to make this opportunity available to as many students as possible.

Welcome from East Tennessee State University

Brian E. Noland, President

East Tennessee State University is committed to the value of research and creative experiences as essential, both to a strong, effective undergraduate education and to preparing students for success in graduate or professional schools and entry into a competitive workforce. We are pleased to collaborate with our sister institutions to feature the accomplishments of our undergraduate research students in the annual Posters-at-the-State Capitol event. Each year, we strive to showcase the diversity of research endeavors at ETSU. This year, we continue this tradition by representing undergraduate research in the musical and theater arts. The strength of our Undergraduate Research Program and the dedicated spirit and commitment of our faculty is reflected in the quality and diversity of the work of these students. I am proud of the efforts made across our campus to introduce students to the vitality, rigor, and excitement of exploration and discovery, and of the many faculty scholars who mentor these students. The ETSU community is pleased and greatly appreciates the response of our State Legislators and Governor to the original and unique achievements of undergraduate researchers across the State of Tennessee.

Welcome from Middle Tennessee State University

Sidney A. McPhee, President

The second goal of our university's Academic Master Plan is to promote individual student success and responsibility for accomplishments through fostering a student-centered learning culture. Creating a culture of research and inquiry for undergraduates through a campus-wide initiative that engages students in a journey of discovery through exploration of real-world research problems is a strategic direction that supports this goal. Our Undergraduate Research Center coordinates students' research efforts across the campus by encouraging participation through initiatives such as the Honors College, FirstSTEP, TLSAMP, URSCA, and other student research experiences. Posters at the Capitol, an event that has been awarded TBR's Academic Excellence Award, is an exciting forum to share our students' work with state legislators.

Our commitment to undergraduate students participating in research is unwavering. I think the quality of the abstracts in this booklet and the posters exhibited at the Capitol will convince you that our resources and efforts are not misplaced. MTSU is delighted to participate in the Posters at the Capitol event.

Welcome from Tennessee State University

Glenda Glover, President

It is my pleasure to welcome you to the Posters at the Capitol event. Undergraduate research is an integral component of our students' educational experience at Tennessee State University and we are honored to be here. Engaging students in the process of science assures the achievement of the highest level of learning. The posters on display by our undergraduate students represent the larger body of research work performed by students across the University's eight colleges/schools.

This level of illustration demonstrated here today, could not have been made possible if not for the dedicated faculty involved. These educators devote an extraordinary amount of time to the research enterprise and to serving as research mentors for our students. Again, welcome and thank you for your continuous support of Tennessee State University.

Welcome from University of Memphis

M. David Rudd, President

Congratulations and best wishes to all of the students participating in this year's Posters at the Capitol event. We recognize the tremendous commitment you have made not only to your individual project, but to the challenge of creating original research within your area of study.

As an urban metropolitan research university, the University of Memphis celebrates undergraduate research as an integral part of our educational mission. We are particularly proud of the work of the outstanding students we sponsor for this event. The intellect, creativity and ingenuity expressed in their collective body of research increases our capacity to change lives in our community.

Thank you to our legislative representatives of the State of Tennessee for hosting this important gathering of scholars so they may share their important discoveries with their colleagues, and with us.

Welcome from University of Tennessee at Knoxville

Donde Plowman, Chancellor

Welcome to Posters at the Capitol, and congratulations to all the students whose hard work is on display at this event. As the state's flagship land-grant university, the University of Tennessee, Knoxville, is committed to research that provides solutions to the most pressing problems that face Tennessee and the world. We are doing more life-changing research on our campus and beyond than at any time in our history. We are also leading most of our national peers in undergraduate research, with a record 4,450 students participating in research projects last year. That's about a fifth of our undergraduates actively engaged in research, which helps them connect more deeply with what they learn in the classroom, prepares them for the workplace or graduate school, and opens opportunities to continue their research through programs both here and abroad. The partnerships we have cultivated with organizations like Oak Ridge National Laboratory, Y-12 National Security Complex, and the Tennessee Valley Authority have given our students unique opportunities to work alongside and learn from faculty and researchers who are foremost experts in their field.

At UT, we are proud of our high standards of research, scholarship, and outreach. UT is delighted to present these research projects conducted by our undergraduate students in Knoxville.

Welcome from the University of Tennessee at Martin

Keith Carver, Chancellor

UT Martin offers multiple academic programs ranked among the best in the state and nation, so we value and promote undergraduate student research as a necessary component for success in many disciplines. This allows students to graduate with hands-on, real-world experience in areas as diverse as agriculture, business, behavioral sciences, humanities and the STEM disciplines. The highly selective UT Martin Honors Programs requires all of its students to conduct research. Undergraduate participation in research projects and funded activities has increased during the past several years, and that investment continues to pay off as many of our students have received recognition for their research in the state, region, and nation.

Our faculty members often couple student research with real-world experiences such as the TVA Investment Challenge, summer internship opportunities at the Oak Ridge National Laboratory, and various other opportunities within grants and governmental programs at the local, state, and national levels.

We are proud to present these selected research projects to represent a cross section of ongoing undergraduate research at UT Martin, and we recognize and thank the faculty members who involve and mentor students in valuable research experiences.

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1.  **Joseph Semler**
Austin Peay State University
Faculty Mentor: Samuel Jator

Rational-Logarithmic 4th Order Method and Application to a First-Order Pantograph Equation.

Rational techniques are a leading method proposed for solving differential equations with singularities and are often comparable to more conventional methods in error. In this paper, we derive and implement a 4thorder Rational-Logarithmic basis numerical technique (RLM4) with a variable controlling parameter for solving singular differential equations. We explore the method's errors and derive its optimal parameter by analyzing the local truncation error. We note that the fourth order RLM is the highest order for which an analytic solution for the parameter is possible. By employing a predictor-corrector mode, our method is both accurate and easy to implement, lending itself to application outside of the field of mathematics. Further, we will adapt the method to solve the first-order Pantograph equation and discuss our approach, a numerical finite-difference technique based on Euler's method, to approximating the delay term. Directions for further study include expansion to higher-order Pantograph equations and other non-analytical singular problems

2.  **Andrew Whitinger**
East Tennessee State University
Faculty Mentor: Chris Wallace

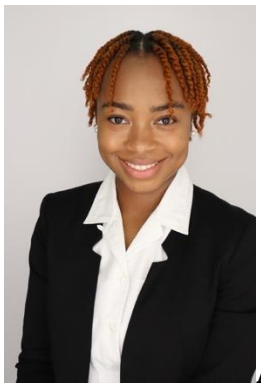
Intraday Algorithmic Trading using Momentum and Long Short-Term Memory network strategies.

Intraday stock trading is an infamously difficult and risky strategy. Momentum and reversal strategies and long short-term memory (LSTM) neural networks have been shown to be effective for selecting stocks to buy and sell over time periods of multiple days. To explore whether these strategies can be effective for intraday trading, their implementations were simulated using intraday price data for stocks in the S&P 500 index, collected at 1-second intervals between February 11, 2021 and March 9, 2021 inclusive. The study tested 160 variations of momentum and reversal strategies for profitability in long, short, and market-neutral portfolios, totaling 480 portfolios. Long and short portfolios for each strategy were also compared to the market to observe excess returns. Eight reversal portfolios yielded statistically significant profits, and 16 yielded significant excess returns. Tests of these strategies on another set of 16 days failed to yield statistically significant returns, though average returns remained profitable. Four LSTM network configurations were tested on the same original set of days, with no strategy yielding statistically significant returns. Close examination of the stocks chosen by LSTM networks suggests that the networks typically buy stocks that outperform during the formation period, mirroring a momentum strategy.

3. Carina Vazquez
Middle Tennessee State University
Faculty Mentor: William Robertson

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 COMSOL.

4.  **Aria McElroy**
Tennessee State University
Faculty Mentors: Anish Jantrania, Terry Gentry, Janie Moore, Tom Byl

To Reuse or Not to Reuse: A Comparison of Wastewater Systems

Wastewater treatment in Texas is a very important issue that many counties have struggled with in recent years. The objective of this project was to analyze multiple onsite wastewater treatments methods to decide which method is best for treating reclaimed water at the RELLIS Campus at Texas A&M University. Each method used to treat wastewater had samples analyzed to detect fecal bacteria, total nitrogen, ammonia, heavy metals, and various other contaminants in the water. There were four treatment options to treat the wastewater from the RELLIS Campus. The conventional septic system, aerobic treatment system, the ozonation method combined with distillation, and the membrane bioreactor. It was concluded that the ozonation method provided the best results for disinfecting wastewater.

5.  **Hannah Anderson**
University of Memphis
Faculty Mentor: Gary Bowlin

Evaluating Neutrophil Physiological State Upon Template Interaction with Deconvolved Z-Stack Imaging

Our knowledge regarding neutrophil response to biomaterials is still limited. In this study, we classified neutrophil degradation into four physiological states, with the final stage being NETosis. Quantifications of these neutrophil physiological states were evaluated in response to collagen, fibrinogen, gelatin, and polydioxanone (PDO) electrospun templates with target diameters of 0.4-0.6 µm for small diameter and 1.5-2.0µm for large diameter. It was hypothesized that PDO would induce the least traumatic neutrophil response. The biomaterials were electrospun at fiber diameters 0.58 ± 0.2µm and 1.68 ± 0.2µm.

Neutrophils' *in vitro* responses were evaluated at 3, 6, and 24 hours. Deconvolved Z-stack fluorescent images were produced. Original MATLAB code was applied to images to quantify neutrophil states. Non-parametric statistical analysis was conducted. In this preliminary data (n=3), collagen electrospun biomaterial caused the least traumatic neutrophil response, while PDO templates caused a more traumatic neutrophil response than hypothesized. Gelatin and fibrinogen templates provided a mechanically unreliable response. This study was the first of its kind to combine this novel imaging technique in combination with original MATLAB code to quantify neutrophil states. In future research, larger sample sizes and parametric statistical analysis will produce meaningful data to impact the next generation of regeneration templates.

6. Ashlei Williams
University of Tennessee, Knoxville
Faculty Mentor: Maitreyi Das

A Goldilocks Enigma: How Cells Internalize Cargo for Proper Growth

Endocytosis is a fundamental cellular process, facilitating growth in cells for their development and survival. This complex process permits internalization of cargo/nutrients into the cell by membrane bending. Endocytic defects impair growth, cell function, and are associated with several diseases such as cancer, cardiovascular and neuronal disorders. Cargo internalization via membrane bending and pinching-off requires adequate force generated by proper organization of the actin cytoskeleton. However, it is unclear how actin is optimally organized for endocytosis. Our research shows that a highly conserved signaling protein, Cdc42, regulates endocytosis. Cdc42 is conserved from yeast to mammals; thus, we use yeast as a simpler yet relevant system to uncover how it regulates endocytosis in real-time using live-cell microscopy. Specifically, when Cdc42 is overactive, the distribution of endocytic sites is disrupted, and endocytosis fails to internalize cargo. Additionally, when Cdc42 activity is decreased, cargo internalization takes longer. These observations indicate that there is a "Goldilocks" amount of Cdc42 activity necessary for proper endocytosis. Accordingly, we find that Cdc42 misregulation alters the recruitment and dynamics of an important motor protein, Myo1, that promotes actin organization during endocytosis. In future work, we will determine the molecular details of how Cdc42 regulates Myo1 during endocytosis.

7. 

Cathryn Hunt
University of Tennessee, Martin
Faculty Mentor: Saman Sargolzaei

Scarecrow's Revenge - Tennessee Corn Promotion through Game Development

Interactive 3-Dimensional games can be classified as an active learning methodology to affect educational goals positively. Our work presents the development of a 3- Dimensional interactive game to promote the Tennessee corn. The game is developed in Unity engine (version 2020.3.12). It is a single-player, first-person perspective game, where the arrow keys make a farmer character navigate turns and obstacles within a corn maze. Scarecrows will appear over the game course and force the player to answer a trivia question about corn production and usage. The player moves forward unchanged with correct answers to the trivia questions; however, the player will lose a life from their five-life total with an incorrect answer. The goal is to escape the maze by correctly answering trivia questions, navigating the maze, and finding bonus lives scattered throughout. The presentation discusses the design process of player movements, camera movements, objects interactions, and other gameplay mechanics.

8. 
Brianna Martinson
East Tennessee State University
Faculty Mentor: Mathew Desjardins

Resolution Affects Users' Immersion in Virtual Reality and Implications for Virtual Reality in Therapeutic Applications

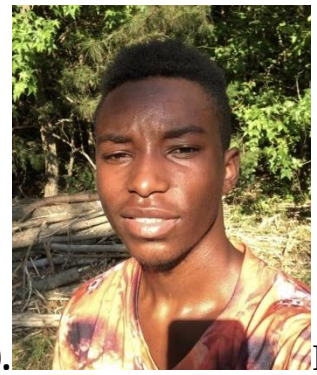
Studies of how users experience Virtual Reality (VR) have thus far failed to address the extent to which rendering resolution and rendering frame rate affect users' sense of immersion in VR, including applications of VR involving simulators, treatments for psychological and mental disorders, explorations

of new and nonexistent structures, and ways to understand the human body in medical applicationsbetter.This study investigated if rendering resolution affected users' sense of immersion in VR. The study comparedthe responses of two groups relative to two measures of participant immersion: (a) participant's sense of presence and (b) participant's sense of embodiment. The treatment levels were (a) low 512 pixels per inch (ppi) and (b) high 2048 ppi rendering resolution. One potential moderating variable, game type, varied over three levels: narrative, objective, and situational. The participants were randomly assigned to a treatment level to account for previous VR experience. Neitherparticipants nor the research observer knew the treatment level. Data indicated that the rendering resolution did not affect user immersion; however,game type did affect immersion. The situational game type was determined to be significantly more immersive than the other game types.

9. DaVonte Lewis
Middle Tennessee State University
Faculty Mentor: Hanna Terletska

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.

10.  **Baron Hill**

Tennessee State University

Faculty Mentor: Tom Byl and Emmanuel Omondi

The Effect of Sulfide-Rich Water on Hemp Seedling Growth

Previous research found water enriched in sulfide stimulated plant growth. This study's objective was to determine if groundwater from Tennessee State University's farm well naturally rich in sulfide stimulated hemp growth. Cannibas sativa, variety Henola, were raised in the lab under constant light and temperature using waters containing high sulfide (65-105 mg/L) or no sulfide. The sulfide-rich treatment was compared to plants raised using the same water treated with hydrogen peroxide to oxidize the sulfide to sulfate. Ten days after planting, hemp raised in sulfide-rich waters were significantly taller (average 3 cm) as compared to seedlings raised in oxidized waters (2 cm tall, $p = 0.01$). Additional shoot, root, body weight and enzyme levels will be measured to determine if sulfide enhances hemp fiber production.

11.  **Razan Sweileh**

University of Memphis

Faculty Mentor: Amy Abell

MAP3K4 Kinase Inactivation Leads to Fetal Growth Restriction in Mouse Embryos

Fetal growth restriction (FGR) occurs when the fetus does not grow to its full, genetic potential. FGR causes life-long complications, including immune deficiencies and neurological issues. The leading cause of FGR is placental defects; the placenta is the communication channel between the mother and the growing fetus. The placenta is composed of mature trophoblast cells that highly express the mitogen-activated protein kinase kinase kinase 4 (MAP3K4). This enzyme phosphorylates its downstream substrates to regulate cellular functions and induce physiological responses for proper development. Inactivation of the *Map3k4* gene results in embryonic lethality. Surviving kinase-inactive mice show

reduced growth during aging. We hypothesized the complications in adults were due in part to disruptions during gestation. Subsequently, this current study examined embryonic length, liver area, and placental size in mouse embryos at 13.5 days of development. We found that inactive MAP3K4 embryos (*Map3k4*$^{KI/KI}$) had reduced embryonic length, liver area, and placental size when compared to wild-type MAP3K4 embryos (*Map3k4*$^{WT/WT}$). These findings indicate that MAP3K4 controls placental and embryonic growth, and loss of MAP3K4 activity leads to FGR. Future studies will focus on examining the placenta to understand the molecular mechanisms controlling the pathology of FGR.

12. Ashlyn Anderson
University of Tennessee, Knoxville
Faculty Mentor: Betsy Anderson Steeves

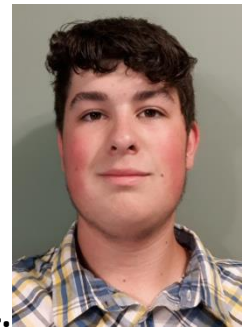
Navigating Hidden Hunger: An Exploratory Analysis the Lived Experience of College Student Food Insecurity

College students are considered a vulnerable population to food insecurity (FI), which has significant implications on academic and health outcomes. Few qualitative studies have investigated the meaning of student FI to advance policy and inform sustainable interventions. This study aims to explore the lived experience of college students by assessing the impact of FI on food decisions, perceived barriers and facilitators to food access, and the utility of on-campus interventions. Semi-structured qualitative interviews were conducted with 30 food insecure students at a large, public land grant university in the Southeast US. Data were coded using grounded theory methodology and an inductive approach. A coding scheme of emergent themes was developed from the interviews using NVivo qualitative analysis software. Several themes emerged: the normalization of food insecurity, comparison to other students who are perceived to be worse off, the stigma of receiving aid, and the financial burden of higher education. Students also discussed the short-term sacrifice of food for the long-term gain of a college degree and improved career outcomes. The findings are formative to improving institutional food resources to best meet the basic needs of students and evoke action at the policy level to support student food security.

13. Erin Evans
University of Tennessee, Martin
Faculty Mentor: Saman Sargolzaei

Corn, as Never Seen Before! A Virtual Reality Tour of the Tennessee Corn

Virtual reality (VR) has been extending its reach to many disciplines. One such utilization has been remote education and outreach. In this study, we utilize the VR technology to develop a virtual tour of the Tennessee corn. Our aims included consumer education, providing educators with resources, expanding market opportunities, and sustaining economic viability. The tour is being developed in Unity game engine using a collection of 360 images captured at different time-points from the seed planting to the harvesting season. The core elements of the tour are centered around the user immersion in a Tennessee cornfield. The entry of our interactive VR tour features a menu with choices of different time-points. Upon user selection, the user will be immersed in a scene that is overlaid with audio, video and text hints related to the corn farming and use. The furtherment of this research is to develop smart-phone application of the tour and reach out to our county's middle and elementary schools to educate future generations about such a wonderful crop we have in Tennessee.

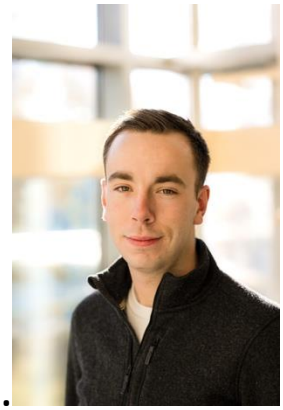


14. Joseph M. Hewa
East Tennessee State University
Faculty Mentor: Beverly J. Smith

Classifying Quenching Galaxies: Comparing Methods

Quenching galaxies are galaxies that are rapidly evolving from strongly star forming systems to galaxies with mostly old stars and low star formation rates. When identifying quenching galaxies, there are several methods in common use. Furthermore, there are several ways astronomers estimate the Star Formation Rate (SFR), in Solar Masses per year, and Stellar Mass (M*), in Solar Masses, of

galaxies. For a large sample of galaxies, we used 6 derivations of M* and 4 for SFR, plotting them against each other for comparison. We also calculated and compared the specific SFR (sSFR), equal to SFR/M*, and compared the different methods of defining quenched galaxies. Finally, we divided up these plots by classification, Red Sequence/Green Valley/Blue Cloud, and different values of log (SFR). This project was completed with the support of a grant from the NASA Tennessee Space Grant Consortium.



15. Hunter Brady
Middle Tennessee State University
Faculty Mentor: Anthony Newsome

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.

16. Kameron Brooks
Tennessee State University
Faculty Mentor: Margaret Whalen

Effects of Hexabromocyclododecane (HBCD) Exposures on Interleukin 6 (IL-6) Production in Human Monocyte-depleted Peripheral Blood Mononuclear Cells (MD-PBMCs)

Hexabromocyclododecane (HBCD) is a brominated flame retardant that is used in a variety of applications including insulation and upholstery. This environmental contaminant accumulates in living organisms and is found in human blood samples. Interleukin 6 (IL-6) is a pro-inflammatory cytokine produced by T-lymphocytes, monocytes, and other cells. It regulates cell growth, tissue repair, and immune functions. HBCD has been shown to increase the secretion of another pro-inflammatory cytokine, IL-1β. The current study addresses whether HBCD is able to alter the secretion and/or intracellular levels of IL-6, thus potentially causing unwanted inflammation. Monocyte-depleted peripheral blood mononuclear cells (MD-PBMCs) were exposed to HBCD ranging from 5 – 0.05 μM, for 10 min and 24h. IL-6 production was evaluated by measuring both the secreted (via enzyme linked immunosorbent assay (ELISA)) and the intracellular levels (via western blot) of IL-6 from the same cells. Results indicate that exposures to HBCD for 24h increases both the secretion and intracellular levels and thus the cellular production of IL-6 from these cells. Thus, HBCD-induced increases in secretion of IL-6 are not simply due to release of pre-existing IL-6 stores. This suggests that HBCD may have the capacity to cause inflammation in the absence of any injury or infection.

17. Samantha Hall
University of Memphis
Faculty Mentor: Joel Bumgardner

Analysis of in-vivo Macrophage Polarization in Response to Raspberry Ketone-loaded Chitosan Membranes for Guided Bone Regeneration

Guided bone regeneration (GBR) is used to enhance bone growth and treat alveolar bone loss. Nanofibrous electrospun membranes made from chitosan have shown promise for enhanced GBR. During wound healing, macrophages polarize along a spectrum from a pro-inflammatory phenotype (M1) to an anti-inflammatory phenotype (M2). A strategy that can be implemented to facilitate healing is the promotion of macrophage polarization. Raspberry ketone (RK) is a natural phenolic compound that possesses antioxidant and anti-inflammatory properties. In previous *in-vitro* research, RK has shown promise in accelerating macrophage polarization. In this study, electrospun chitosan membranes (ESCMs) were used to deliver RK to an *in-vivo* bone defect site using a rat calvarial model. ESCMs were loaded with 250 or 0 µg RK. Membranes from each treatment group were implanted into rat calvarial defects (n=8). Membranes and surrounding tissues were extracted in serial sections and immunohistochemically stained at 1, 2, and 4 weeks using individual markers for M1(iNOS), M2 (CD206), and total macrophages (CD68). Images of the stained tissues were obtained, and the percent-stained area was quantified using NIH ImageJ. Results indicated that ESCMs loaded with 250 µg RK have potential for facilitating macrophage polarization in bone defects. However, further dose dependent analysis is required.

18. Brittany Okweye
University of Tennessee, Knoxville
Faculty Mentor: Jill Maples

Biomarker to Predict Metabolic Dysfunction During Pregnancy

There is much to be discovered about maternal and fetal metabolic changes during pregnancy. This leads to a need for different markers that diagnose metabolic dysregulation. Women who develop uncontrolled gestational diabetes meletus (GDM) could be at riskfor various long-term health issues like cardiovascular disease, chronic kidney disease, and cancer. The neonate could also develop childhood obesity due to the mother's uncontrolled GDM. There's a fervent need for an early approach to diagnose maternal metabolic dysfunction because it is currently diagnosed in the 3rd trimester. So, if GDM could be diagnosed and treated earlier in pregnancy, more maternal health complications could be prevented. This study aims to investigate if fasting lactate values in pregnant women could be used as a biomarker for metabolic dysfunction to predict metabolic diseases like GDM. We hypothesize that women who fail their 3-hour glucose (OGTT) test, screening positive for GDM, will have higher fasting lactate than women who pass their 3-hour OGTT. The study will examine 50 pregnant women who screen positive for "at-risk" for GDM, they will take a 1-hr OGTT, and if they fail, they are to take a 3-hour OGTT. We have recorded demographic questions, weight, BMI status, height, andseveral metabolic values like lactic acid and insulin, and glucose values at each hour of fasting for the 3-hour OGTT for 44 pregnant women. The study is ongoing, so this poster is not conclusive.

19. Patrick Park
University of Tennessee, Martin
Faculty Mentor: Seyedali Seyedkavoosi

Waste heat recovery by Organic Rankine cycle from biodiesel: A case study for Northwest Tennessee

Electricity costs average around 4% of total expenses for a farm business and managing electricity costs may be a way to reduce operating expenses. Due to the increasing presence of biodiesel in the state of Tennessee, in this work, we proposed a small-scale basic organic Rankine cycle (ORC) waste heat recovery system from an internal combustion engine (ICE) suitable for farms in rural Tennessee. We found an overall system efficiency to be up to 20%. Our considered system also provides hot water for domestic use through the exchange of heat from the ICE to the ORC, whileleaving the overall ORC efficiency constant. The engine is fueled by B10 biodiesel sourced from corn oil and is analyzed for an engine speed of 1700 revolutions per minute at 50% load. The chosen working fluid for the ORC is R134a for efficiency, environmental, and safety purposes. The net power of the waste heat recovery system was found to be about 38kW. Based on the obtained values, this system could create a net income $30,000 a year based on the price of electricity in Tennessee.

20. Pamela Avendaño Rubi
East Tennessee State University
Faculty Mentor: Cerrone Foster

Long Term Estrogen Loss Worsens Heart Function in Aged Female Mice

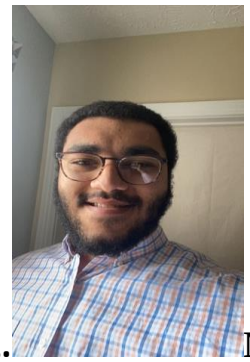
Heart disease is the leading cause of death worldwide and according to the American Heart Association, the risk of HD in aging menopausal women doubles compared to men of the same age. Excessive contractility of blood vessels is a common feature in heart disease. Clinical and animal studies further

support that estrogen loss worsen the contractility in the heart but the details remain unclear. Thus, the overall goal of this work was to examine how the timing and duration of estrogen loss affects heart failure. Our hypothesis is that long-term estrogen loss following heart failure worsens cardiac function of the aged female heart. To mimic menopause, we surgically removed the ovaries from female mice at2.5months of age, waited 5 or 12 months for estrogen loss, and induced heart failure using a drug that increases the contractility of the heart. Our results show that estrogen loss at 12 months caused a greater impairment on the heart's response in increased contractility of the heart. Understanding the effects of estrogen loss and HD is crucial to improving and finding alternative treatments for heart diseaseinaging menopausal women.

21. Logan Carver
Middle Tennessee State University
Faculty Mentor: April Weissmiller

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 N- MYC 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.



22. Mohamed Mohamed
Tennessee State University
Faculty Mentor: William Boadi

Lipid peroxides (LPs) and, Glutathione (GSH) in Pooled Liver Microsomes (HLMs) following Exposure to Flavonoids

Oxidative stress causes a variety of diseases. It can decrease the levels of glutathione (GSH) in cells, which can potentially lead to the development of cancer. A defense mechanism in cells against the oxidative stress is the GSH-Redox system involving GSH-reductase (GSH-R), GSH peroxidase (GSH-Px), and superoxide dismutase (SOD). In this study, cells were cultured to study the effects of the flavonoids; genistein (G), quercetin (Q) and kaempferol (K) on the modulation of lipid peroxides (LPs) and GSH levels in pooled human liver microsomes (HLMs) following exposure for 4, 6, 18 and 24 hr. after the oxidative stress. Our hypothesis was that the flavonoids can decrease LPs through the elevation of intracellular GSH to offset the oxidative stress. HLMs were subjected to the Fenton's pathway, using 20 µM Fe^{2+} and 0.1 mM hydrogen peroxide (H_2O_2), with or without flavonoids at 0, 5, 10, 15, 20 and 25 µM for the said incubation times. LPs decreased significantly ($p<0.05$) with increased flavonoid concentration. Decreases were time-dependent with Q being the best followed by G and K respectively. GSH increased in a dose- and time-dependent manner with Q being significantly ($p<0.05$) more effective than G and K. Results indicate that the flavonoids increase GSH levels in HLMs to lower the oxidative damage.

23. Sarah Coleman
University of Memphis
Faculty Mentor: James Adelman

Is House Finch Leg Brightness an Indicator of Physical Condition?

Among various animals, mate choice is often associated with physical characteristics, such as coloration, which signal survival or reproductive potential. Although bright, flashy colors, like reds and yellows, are often studied, it remains unclear whether subtler colors, like browns and grays, also play a role. To determine if subtle coloration correlate with fitness in a species that also displays well-known flashy signals, I examined house finch (*Haemorhous mexicanus*) leg color after experimental infection with a bacterial pathogen, *Mycoplasma gallisepticum*, which causes seasonal epidemics in this species. I used spectrometry to determine whether leg brightness (visible and UV spectra) differed between finches inoculated with isolates of varying doses and virulence. Results indicated that birds infected with the more virulent isolate had lighter legs compared to the control birds. These results suggest that subtle grays and browns could indicate infection status, and therefore survival potential, in a species known to show signals using coloration. However, because these birds were tested after infection, further work is needed to investigate whether these same relationships signal fitness during infection, which better indicates survival probability. Nevertheless, my work suggests that subtle coloration could play role in signaling survival, with the potential to influence mate choice

24. Isabel Boyd
University of Tennessee, Knoxville
Faculty Mentor: Jalonda Thompson

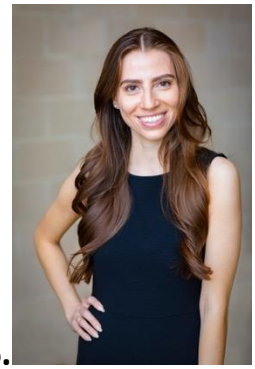
Bridging the STEM Gender Gap through Women Focused Outreach

Women in STEM fields have been highly researched, and while all sources have different perspectives on the topic, they each have a factor in common: women are not treated or represented equally in STEM fields. Changes are necessary to fix this problem. By focusing on the various factors affecting women in STEM at the University of Tennessee, Knoxville (UTK), wehope to elicit conclusions and illuminate insights that can be seen at similarly large public universities. We surveyed first-year female students in the Tickle College of Engineering to investigate the most significant push and pull factors when considering a STEM career. Students reported similar feelings to what was present in the literature, including having intrinsic and extrinsic motivation related to past experiences and career goals. They also want to see more female role models in the field and later serve that purpose for others. Notably, many reported feeling resigned to experiencing misogyny. The application of these broader concepts to the practical concerns of UTK students can lead to conclusions about what changes and improvements can and should be made to increase female participation and acceptance into the STEM community locally at UTK and more broadly.

25. Sheyda Amirfaiz
East Tennessee State University
Faculty Mentor: Sean Fox

Using Polymicrobial Interactions to identify possible novel targets in Staphylococcus, Bacillus, and Candida

Microbes all compete for the same limited nutrients, space, and resources; therefore, they show competitive relationships. There is a component of Alcaligenesfaecalis that inhibits the growth of Staphylococcus aureus, agram-positive bacterium that causes many clinical diseases. We are interested in finding what genetic factors in Alcaligenesfaecalisareresponsible for killing Staphylococcus aureus. Transposonmutagenesis was used to interrupt certain gene segments by introducing a foreign piece of DNA into the Alcaligenes faecalisgenome. By creating mutants of Alcaligenes faecalis, we were able to test these against Staphylococcus aureus to find those that can no longer inhibit. The absence of zones of inhibition indicated that we successfully interrupted the genetic element in Alcaligenes faecalis that kills Staphylococcus aureus. The genome of the mutants that presented no zones of inhibition were isolated to perform RACEPCR. After completing RACEPCR, the mutants were visualized using gel electrophoresis, and they were sequenced. In the sequence, we discovered that the gene that was being interrupted was MFS Transporter. This is an important transporter in bacteria for virulence, metabolism, and quorum sensing. Results from this study may help us find new targets for Staphylococcus aureusinfections.

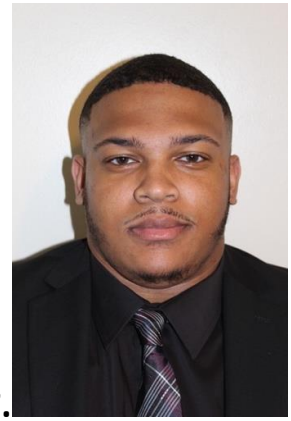


26. Maria Clark
Middle Tennessee State University
Faculty Mentor: Kevin Bicker

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

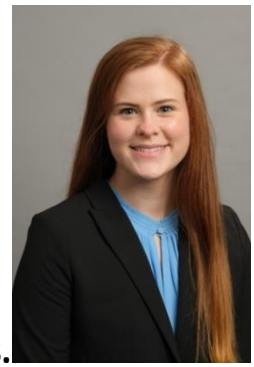
of 81% percent, with high incidence in those who are immunocompromised. Current antifungal treatments such as fluconazole and amphotericin B have detrimental side effects, leaving a significant need for better alternative treatments. Peptoids, which are mimics of the natural peptides found in living 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.



27. Rodney McCracken
Tennessee State University
Faculty Mentor: Lisa de la Mothe

Regional Rostrocaudal Comparison of Calbindin and Calretinin in the Auditory Cortex

In order to development a foundation for understanding sound and auditory processing, establishing a comprehensive framework of the structural and neurochemical organization of the auditory system is required. Studies have demonstrated changes in expression patterns of various neurochemical markers between regions (Hackett & de la Mothe, 2009) as well as within regions along the rostrocaudal axis (de la Mothe et al. 2006a). We analyzed the rostral sections of the auditory cortex in marmoset monkeys across regions including the core, medial belt, lateral belt, and parabelt for expression and co-expression of two calcium binding proteins, calbindin and calretinin. Multi-fluorescent immunohistochemistry (IHC) was performed in order to visualize several neuroanatomical markers in the same tissue section. Cell counts were performed for calbindin and calretinin as well as the co-localization of the two proteins in all regions of rostral auditory cortex and compared with established patterns from caudal auditory cortex. Results indicate largely distinct populations of calbindin and calretinin in rostral areas across regions with few incidences of co-localization and shifts in expression between regions themselves, unlike caudal areas that showed more coplocalization. These findings are consistent with previously reported shifts in architecture and anatomical markers along the rostrocaudal axis in auditory cortex.



28. Shannon Wallace
University of Memphis
Faculty Mentor: Gary Bowlin

Effectiveness of Verteporfin in Reducing Neutrophil Extracellular Traps (NETs)

Neutrophils, a type of white blood cell, respond to foreign bodies by releasing neutrophil extracellular traps (NETs) to isolate and eliminate the foreign body. In this study, the drug verteporfin was analyzed to determine its effects on NET release. Verteporfin has shown promising results in reducing fibrosis by blocking the YAP protein. Verteporfin solutions were made with drug concentrations ranging from 5 ng-200 mg. Each drug solution was dissolved into a dimethylfuran (DMF) and phosphate-buffed saline (PBS) solution of 1:7 and stored at room temperature. Human neutrophils were collected from the blood of a healthy donor and were isolated within thirty minutes after collection. The neutrophils were seeded into a 96 well plate with each well containing 100,00 cells, 10 µL of verteporfin, and 10 µL of 75 mg of phorbol myristate acetate (NET inducer). After 1 and 3 hours, the plates were removed from an incubator and any NETs released stained with sytox orange. Then, each plate was analyzed using spectrophotometry to determine the amount of NETs present within the wells. The decrease of NETs within the verteporfin wells shows great potential for the drug in reducing NET release from accruing, thus leading to the body accepting implants.

29. Keri Burge
University of Tennessee, Knoxville
Faculty Mentor: Anneke Janzen

Exploring Early Colonial Human Management Practices in Virginia: A View from Coan Hall

When European settlers first arrived in North America, they brought new species and land management practices. Detailed information about early European colonists'agricultural and animal husbandry

practices can be viewed through carbon and nitrogen isotopic analysis of archaeological plant and animal remains. This researchanalyses the multicomponent site of Coan Hall (44NB11) in Northumberland County, Virginia. This siteoffers unique insight into early colonial life in the Northern Neckregion. Stable isotope analysis of charred seeds and livestock bones excavated from a cellar with two main occupation periods elucidates a diachronic view of agricultural and animal management strategies in the 17th and early 18th centuries as colonial settlement took holdin the Chesapeake. When coupled with documentary evidence of farming practices, this study provides an isotopic baseline to study the impact of colonial farming practices and their development over time.

30. Shivam Patel
East Tennessee State University
Faculty Mentor: Sean Fox

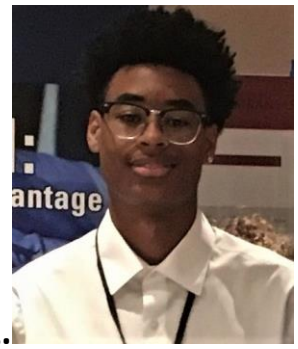
Project to Enhance Inquiry-Based Learning by Mapping the Microbiome of the Southern Appalachian Region

As humans continue to advance healthcare resources, we face a growing threat of nosocomial multidrug-resistant bacteria. The rise of these antibiotic-resistant microorganisms has been placed on the World Health Organization's watchlist as one of the biggest threats to global health. We continue to have a shortage of effective antibiotics with the rise of these "superbugs". With the growing number of deadly pathogens, the future of medicine relies on scientific findings to combat multidrug-resistant bacteria. Appalachia could be the answer to combat this new health threat. As the most biodiverse temperate forest region in North America, our beautiful backyard in the Smoky Mountains contains a plethora of microorganisms that have become genetically diversified over billions of years. Many of these soil bacteria naturallyproduce their own antibiotics. With the wide variation of natural bacteria, Appalachia serves as a testing ground to harness the power of natural antibiotics. A gram of soil contains more than 10,000 different species of bacteria. The biodiversity of these microbes is still largely unknown, as almost 99% of these species cannot be cultured in a normal lab setting. This pilot project will lay the foundations of discovering Appalachia's microbiota which has, thus far, never been cataloged.

31. Sophia Taylor
Middle Tennessee State University
Faculty Mentor: Scott Handy

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.



32. Tyrese Stanford
Tennessee State University
Faculty Mentor: Tom Byl and De'Etra Young

Harmful Algal Blooms: Microcystin Toxin and Nutrient Analysis in the TSU Wetland

Cyanobacteria capable of producing microcystin toxins flourish in the wetland at Tennessee State University in Nashville, TN posing a danger to livestock and wildlife. The objective of this research was to measure microcystin and water chemistry to determine trends through time. Samples were collected at 4 locations in the wetlands between 2017 – 2019 and analyzed for nutrients (nitrogen, phosphorous), iron, sulfur, Secchi depth, type of algae present, and microcystin. Continuous water-quality instruments were

also installed at the inlet and outlet to document dissolved oxygen, pH, temperature, specific conductance and turbidity. Seven cyanobacteria genera capable of producing microcystins were identified. Microcystin concentrations ranged from less than 0.15 to 25.1 µg/L, and peak microcystin concentrations were well above the US EPA's health advisory concentration of 0.3 µg/L. The highest concentrations of toxin were located near the livestock access point. Additional work includes correlations between water chemistry parameters and microcystin concentrations.

33. Morgan Lane
University of Tennessee, Knoxville
Faculty Mentor: Ben Allen

Influence of Red and Blue Wavelengths on the Pupil Light Reflex

Trichromatic vision arises from the three opsin cones present in the human retina. These three cones are generally referred to as "S," "M," and "L." Short-wavelength light maximally activates "S" cones, medium-wavelength light maximally activates "M"cones, and long-wavelength light maximally activates "L" cones. The fovea has an abundance of M and L cones, while S cones are sparse. Previous studies show the wavelength of the light stimulus impacts the constriction of pupils in response to bright light. However, most of these studies compare medium and long-wavelength light. Thus,we compared the magnitude of pupil constriction in response to short and long-wavelength light. Our results showed the magnitude of pupil constriction was similar in response to short (1.43 mm) and long (1.36) wavelength light ($p = .154$). While we controlled the intensity of the different light probes via hexadecimal red-green-bluecodes, a chronometer was not used. It may be that the short and long-wavelength lightprobes differed in intensity, distorting the comparison. Further studies should use achronometer to validate luminance levels of color conditions

34. Thomas Dylan Boyer
East Tennessee State University
Faculty Mentor: Diana Morelen

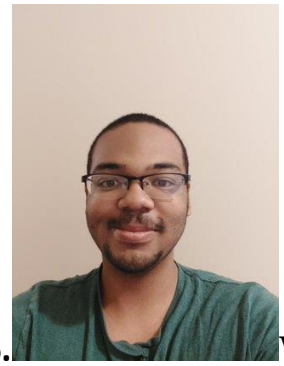
Exploration of treatment resistance in a parenting skills group for at-risk mothers

Treatment resistance is a consistent impediment across psychological interventions. Specifically, the prevalence of adverse childhood experiences, and symptoms of depression, have both been posited to contribute to this phenomenon. This is noteworthy, particularly in parenting interventions, given that maternal ACEs and depression are predictors of suboptimal parenting outcomes and thus the risk factors that increase need for intervention may simultaneously be the very factors that impede with one's intervention engagement. This study explored if this phenomenon replicates in Mom Power -a 10-week, trauma-informed, parenting skills group for at-risk mothers. A multiple linear regression was performed to predict intervention attendance (could range from 0-10)based on ACE score and maternal depression at pre-treatment for n = 66 mothers of young children (ages 0-5). The overall model was not significant $F(2, 59) = 1.07$, $p = .35$. Further, maternal ACE scores and depression symptoms only accounted for only 3.5% of the variance in intervention attendance. The authors propose that the trauma-informed Mom Power intervention may be addressing the treatment resistance of at-risk mothers, and that Mom Power effectively engages mothers despite ACE scores or depression symptoms.

35. Sydney 'Quinn' Wilson
Middle Tennessee State University
Faculty Mentor: Chuck Higgins

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 shapefound 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.



36. W. Tristan Cannon

Tennessee State University
Faculty Mentor: William Boadi

Effects of Chronic Exposure of Pooled Human Liver Microsomes (HLMs) to Quercetin on Lipid Peroxides and Glutathione

Oxidative stress is the imbalance between exposure to reactive oxygen species (ROS) and antioxidants. This imbalance has been implicated in tumorigenesis in some cells. We have previously reported on the effectiveness of quercetin (Q) and its antioxidant properties in several cell types following acute exposure. As to the effectiveness of exposure of cells to Q over longer incubation periods on lipid peroxides (LP) and the intracellular glutathione (GSH) levels in cells are limited and not conclusive. In this study, HLMs were exposed to several doses of Q to test if there is any correlation between LPs and GSH following exposure for 24, 48 and 72 hr. following the oxidative stress. Our findings indicate that LPs decreased significantly ($p<0.05$) with increases in Q concentration over time. Furthermore, GSH levels also increased in a dose- and time-dependent manner. The studies indicate that Q can reduce LPs through its extended antioxidant potential as well as the regeneration and/or preventing loses of intracellular GSH in HLMs over time. We report here our, novel findings on the mechanisms of action of Q probably through the induction of the cytochrome-P450 3A4 (CYP3A4) which we have observed and may relate to LPs and GSH levels in HLMs.

37. Owen Queen

University of Tennessee, Knoxville
Faculty Mentor: Christopher Strickland

Agent-Based Social Network Models of the Prescription Opioid Epidemic

The opioid epidemic is a public health crisis in the United States, with approximately 70% of all drug overdose deaths attributed to opioids. While ordinary differential equation (ODE) models have been used to study this epidemic, these models ignore the effect of community structure on the spread of addiction. As a result, ODE models often lack the flexibility to model rural populations, where community structure has a more significant epidemiological impact. This study investigates agent-based models, an alternative to ODE models that allow for social network structures variation. By implementing four different network structures –fully connected, Erdos-Renyi, Barabasi-Albert, and Watts-Strogatz –analysis was conducted to examine the effects of varying network parameters on the progression of prescription opioid and heroin addiction in a population. In addition, optimization techniques were used to find the corresponding rates needed for an ODE model that compensates for community structure. Statistical analyses reveal that one summary statistic, average path length, can reasonably predict heroin addiction within a population while the susceptible-to-heroin addiction pathway is most affected by changes in community structure. This research provides a framework for researchers to explore the population-level dynamics of opioid addiction, leading to the study of mitigation strategies.

Posters at the Capitol Organizing Committee

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Director of Outreach and Communications, Tennessee STEM Education Center at MTSU

Tim Atkinson, Austin Peay State University
Director, Research and Sponsored Programs

Trena Paulus East Tennessee State University
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POSTERS AT THE CAPITOL

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