

PROCEEDINGS

OF THE

NINTH ANNUAL UNDERGRADUATE RESEARCH
SYMPOSIUM



THE UNIVERSITY OF
TENNESSEE
KNOXVILLE

PROCEEDINGS

of the

Ninth Annual Undergraduate Research Symposium

April 13th, 2018

The University of Tennessee, Knoxville
John C. Hodges Library

The Ninth Annual Undergraduate Research Symposium is organized by the Undergraduate Research Students' Association (URSA), which was founded in 2010 and is dedicated to expanding access to research for undergraduates at the University of Tennessee, Knoxville. The Symposium provides a space for undergraduates in all disciplines to give oral presentations of their work to an audience composed of the general public, their professors, and their peers.

More information about URSA can be found online at www.ursautk.org.

The Ninth Annual Undergraduate Research Symposium is sponsored by the Office of Undergraduate Research. We especially thank the John C. Hodges Library and its staff for their gracious accommodations for this year's Symposium.

URSA Executive Board

Brandon Barker

Thomas Clarity

Benjamin Cruz

Sophia Cui

Codi Drake

Samiha Hossain

Chris Muir

Breanne Rackley

Andrea Ramirez

Schedule of Events

8:30 - 8:55 AM

BREAKFAST AND REGISTRATION

Please join us for coffee and breakfast pastries in the Mary Greer Room (room number 258) of Hodges Library.

9:00 - 9:55 AM

SESSION I

10:00 - 10:55 AM

SESSION II

11:00 - 11:55 AM

SESSION III

12:00 - 12:55 PM

LUNCH

Lunch will be served in the Mary Greer Room (room number 258) of Hodges Library.

1:00 - 1:55 PM

SESSION IV

2:00 - 2:55 PM

SESSION V

3:00 - 3:55 PM

SESSION VI

4:00 - 4:15 PM

CLOSING REMARKS

Mary Greer Room (Hodges 258)

ABSTRACTS

Alphabetical by Last Name

The Holy Land of the Bible, Archaeology, and the End Times: Christian Dispensationalism and the Archaeology of Israel

Katharine Agbenohevi
Faculty Mentor: Dr. Erin Darby

University of Tennessee, Knoxville
Political Science

Previous scholarship has revealed that the theology associated with contemporary Christian dispensational movements is grounded in literal interpretations of the Hebrew Bible and a perceived connection with the physical land of Israel. Biblical literalism arose during the nineteenth century as reaction to source critical approaches to the Bible, which questioned the historical reliability of the text. Literalism emerged in Britain and America at the same time these nations carried out archaeological projects and evangelical missions in Israel. In fact, these explorations led to the foundation of the discipline of “biblical archaeology” through the discovery of artifacts that reaffirmed the theological beliefs of many explorers.

While scholars address the emergence of literal biblical interpretations and the origins of biblical archaeology, little work has been done to examine the combination of these developments among premillennial dispensationalist movements and their stance on Israel. To that end, in this paper I will present a case study of Chuck Smith and the dispensational movement, analyzing the case study in light of modern dispensational theology, the history of dispensationalism and biblical literalism, and the rise of biblical archaeology in order to better understand the role archaeology may have played in the formation of dispensationalist attitudes toward modern Israel.

Assessing Prenatal Nutritional Information Access, Sources, and Habits in East Tennessee

Bailey Akins

Faculty Mentors: Dr. Sheila L. Taylor

University of Tennessee, Knoxville

Nursing

Maternal action directly affects the life of the developing fetus in the womb. Therefore, understanding maternal health decisions is a critical foundation for improving fetal health in East Tennessee. A review of the literature utilizing Pubmed and CINAHL databases revealed that limited data exists regarding the educational resources given to pregnant women seeking care in Tennessee. The most relevant data on this topic comes from Australia; researchers identified that women mainly received prenatal information from their healthcare provider, media, social networks, and family or friends, but the prenatal information from their health care provider often did not meet their needs. Future research will holistically explore women's knowledge, their sources of recommendation on exercise, weight gain, and nutritional practices during pregnancy, and their compliance.

Assessing the Impact of Canine-Assisted Activities on Middle Adult Patients in the Trauma Setting Using Physical Parameters

Emeri Allan

Faculty Mentor: Dr. Lizanne Elliott

University of Tennessee, Knoxville
Nursing

The human-animal bond is a mutually-beneficial relationship in which humans and certain animals participate. Health, previously regarded as the absence of disease, encompasses every aspect of human life including physical, social, and mental prosperity. To address holistic wellness, it is necessary to investigate the psychosocial effects animals have on people, specifically in clinical settings where individuals experience declines in physical health. Twenty-three references were retrieved from PubMed and CINAHL Complete and synthesized concerning animal-assisted interventions in clinical settings. Researchers have demonstrated that a beneficial relationship exists between animal-assisted interventions and biopsiologic outcome measures among patients of various ages with a wide range of illnesses. Several gaps in the science exist; one such gap pertains to the lack of data on canine-assisted activity in the trauma setting. The purpose of this presentation will be to (1) articulate the state of the science on animal-assisted interventions in the clinical setting, (2) describe a randomized control trial currently being conducted at the University of Tennessee Medical Center researching the relationship between a canine-intervention and trauma patients' vital signs, and (3) discuss preliminary findings.

End of Life Care Disparities in the Hispanic Community

Hannah Anderson

Faculty Mentors: Dr. Mary Lynn Brown & Dr. Millie Gimmel

University of Tennessee, Knoxville

Nursing and Hispanic Studies

Due to advanced health care interventions and medications, the elderly population as a whole is increasing in the United States; the portion of the population that is over 65 is expected to more than double by 2060. In addition, immigration rates are increasing, especially regarding Hispanics. In combination, the older population is becoming more and more racially diverse, with the percentage of non-Hispanic whites over age 65 projected to drop by 24% in 2060. Subsequently, the need for end of life care for Hispanics in our community is growing. However, disparities exist regarding use of end of life services by this population. A comprehensive literature review of 20 studies was conducted. Although it was evident that inequalities do exist, it was not clear why they occur in local Hispanic communities. A survey will be conducted with local Hispanic community members who have varying knowledge on end of life care. Then, an educational seminar will be planned based on those results in order to enhance knowledge of end of life care services. A post-survey will also be conducted to compare understanding before and after the education. There is no data to report since this is an ongoing project. The surveys and educational program, as well as intensive analysis of feedback, are planned during summer and fall of 2018.

Utilization of Liposomes as a Platform to Study Protein-lipid Interactions

Carolyn Barnes

Faculty Mentors: Dr. Michael Best & Dr. Sam Mattern-Schain

University of Tennessee, Knoxville

Chemistry

The field of lipidomics focuses on the many roles that lipids play in cellular functions and has greatly evolved in recent years. Phospholipids are the main constituents of the cellular membrane. The biological functions of phospholipids range from membrane trafficking to signal transduction and intracellular transport, thus linking them to pathological processes. The determination of peripheral membrane binding proteins that interact with the lipid bilayer is a growing field but can be challenging due to protein instability. Here, we use liposomes as a platform to elucidate peripheral membrane protein affinity for particular lipid species. Liposomes are created by varying probe architectures or membrane composition. They are incubated with cellular extracts as a way to capture various membrane binding proteins through photocrosslinking and bioorthogonal click labeling to probe lipids incorporated within the treatment liposomes. The variation of liposome composition is used to resolve how a protein's affinity may change based on cell type or environment. The use of size exclusion chromatography is being explored as a way to enrich cross-linked proteins. Size exclusion chromatography based liposomal protein extraction (SELPE) was created to help isolate peripheral membrane binding proteins. Successful trials have been run utilizing either generic lipid probes or diacylglycerol (DAG)-based probes, each containing a diazirine photo-crosslinking group. Probes can also have a clickable moiety for further enrichment of extracted proteins. Tagged proteins are clicked to a fluorophore for separation and imaging by SDS-PAGE. Proteins may also be excised from SDS-PAGE gels and determined via MALDI-TOF or mass spectroscopy. Recent results in protein identification will also be described.

Prospects for High Energy Follow-up Study of Gravitational Wave Transients

Brandon Barker

Faculty Mentors: Barbara Patricelli from the University of Pisa

University of Tennessee, Knoxville

Physics and Mathematics

As second-generation gravitational wave interferometers, such as Advanced Virgo and Advanced LIGO, reach their design sensitivities, a new lens into our universe will become available. Many of the most violent and energetic events in the cosmos, in particular the merger of compact objects and core collapse supernovae, are sources of gravitational waves and are also believed to be connected with Gamma Ray Bursts. Joint observations of electromagnetic and gravitational wave signals will provide an ideal opportunity to study the physics of these transient events and their progenitors. In particular, gamma ray observatories such as Fermi, coupled with precise sky localization, will be crucial to observe the high energy electromagnetic counterparts to gravitational wave signals. We constructed joint binary neutron star and gamma ray burst detection rate estimates using an analysis pipeline and report on the results of this analysis.

Experiments with Magnetic Susceptibility of Lake Sediments

Luke Blentlinger

Faculty Mentor: Dr. Sally Horn

University of Tennessee, Knoxville

Geography

In paleoenvironmental reconstructions, multi-proxy analyses of sediment profiles recovered from lakes and other inland water bodies can result in a more detailed characterization of past conditions in and surrounding the water body compared to a single-proxy approach. Paleolimnological researchers are often faced with the obstacle of obtaining the maximum amount of information from a limited amount of irreplaceable sediment. One method to maximize data is to use the same sediment sample for multiple analyses when their pretreatment protocols are the same or similar. This study assesses the viability of using the same material for magnetic susceptibility (MS) and X-ray fluorescence (XRF) analyses without contaminating data. Specifically, we tested how varying temperatures and the exposure to metal utensils in sampling and pretreatment can affect MS readings and whether XRF cells for an Olympus BTX profiler can serve as a suitable vessel for MS analysis in a Bartington MS2B sensor.

Device Characterization of GaN Solar Inverters

Katelyn Bolinsky
Faculty Mentor: Daniel Costinett

University of Tennessee, Knoxville
Electrical Engineering

Solar energy is one of the most significant research thrusts in the modern era. Solar inverters are devices used to convert the DC energy of sunlight into AC energy that can be used on the power grid. Typically, they contain silicon; however, new substances such as silicon carbide and gallium nitride are being tested. These materials could increase the efficiency of solar energy, decrease the overall cost, and are potentially more durable than silicon. In order to determine if these new substances can actually benefit the solar industry, they need to be characterized for different attributes with different parameters. As such, my research has been focused on testing these gallium nitride inverters with different packaging to determine different attributes of the devices and finding a new method of storing the data gathered so that it can be easily searched and implemented into the industry with greater ease.

The two main types of testing done on these devices are static and dynamic characterization. Static tests show the behavior of the device when it is fully turned on or off, measuring losses in the device while it is in use. Dynamic tests show how the device works while it is switching between being on and off, measuring the power loss. With this data, I have been working to create a database with searching capability, making it easier for these devices to be analyzed. Having a database like this allows for not only the university, but also the industry in general to keep from repeating tests when the data has already been gathered.

The results gathered so far demonstrate the principle of overshoot present in the devices during shut off, an internal resistance that increases with temperature, and a switching loss, all of which are still being analyzed for exact values relative to silicon and silicon carbide while factoring in cost analysis.

The Needs of Caregivers of NICU Graduates

Megan Borgmier
Faculty Mentor: Dr. Tami Bland

University of Tennessee, Knoxville
Nursing

A neonatal intensive care unit (NICU) specializes in the care of premature or ill infants. Caregivers of infants admitted to the NICU can find themselves in a state of distress that begins at the time of hospitalization but can continue during the discharge process and beyond. The author conducted a literature review to elucidate the state-of-the-science regarding the needs of caregivers of NICU graduates post-discharge and effective strategies to reduce parental distress. While there are a variety of support systems available during the infant's NICU stay, a gap exists regarding support for caregivers post-NICU discharge. It's important to examine the experience of caregivers in the first month post-discharge. The findings from this literature review set the stage for future research by determining if a technology-based support system intervention would meet the needs of NICU graduate caregivers after their infant's discharge. The author created a survey that was distributed to a variety of social media sites in order to understand the distress experienced by NICU graduate caregivers after discharge and discover the interest in digital technology as a support system. This survey received 230 responses. The presentation will include final analyses of quantitative and qualitative data.

Representation of Human Musculature in the Bronze Age Aegean

Emily Brower
Faculty Mentor: Dr. Van de Moortel

University of Tennessee, Knoxville
Kinesiology and Anthropology

Bronze Age Aegean sculptures range from abstract to naturalistic, but how accurate are those naturalistic sculptures? To answer this question, it is useful to compare three Minoan works of art—the large relief of the Prince of the Lilies from Knossos, the Kouros statuette from Palaikastro, and the small relief images on the Boxer Rhyton from Ayia Triadha—with a modern replica of male musculature. This comparison will tell us how much the ancient Minoan people were studying the human body, along with the reasons as to why these sculptures were portrayed with such realistic characteristics. To accomplish this goal this paper takes the artifacts' background into consideration, while measuring the length of several muscle groups and comparing them to a modern anatomical representation.

The results show varied accuracy in comparison to the anatomical models. One of the Minoan artifacts is shown to be almost identical to the anatomical replica. Other conclusions involve the backgrounds of the sculptures, which range from religious contexts to possible images of royalty. Each provides insight into the life of the Bronze Age Minoans. In addition, further study into the Prince of the Lilies from Knossos shows that this relief sculpture was heavily reconstructed, and that there are controversies surrounding the reconstruction.

Communication Difficulties in Stroke Survivors with Aphasia: A Literature Review

Karen Carcello
Faculty Mentor: Dr. Susan McLennon

University of Tennessee, Knoxville
Nursing

Aphasia is a challenging communication impairment and one of the most common causes of disability in the United States. Most cases of aphasia are due to left hemisphere cerebrovascular incident or stroke. The degree of aphasia may be mild, moderate, or severe. Consequences can be overwhelming with psychological, social and emotional implications. The purpose of this literature review was to answer the question: What are the communication challenges and coping strategies used by aphasic stroke survivors. A review of the research literature between 2007 and 2017 was conducted in CINAHL and PubMed databases using key words such as “stroke survivor”, “communication”, and “aphasia” in various combinations. Thirty research articles met inclusion criteria and were selected for review. Two studies examined blog postings. Most studies were about stroke survivors with mild aphasia. Challenges and coping strategies were identified. Aphasia in stroke survivors contributed to significant communication problems and led to serious neurological and psychological effects. No studies focused on the perspectives of stroke survivors with severe aphasia, a notable gap in the literature. Future research will focus on blog posts written by caregivers and stroke survivors living with severe aphasia to gain a deeper understanding of their experiences.

Neonatal Abstinence Syndrome Treatment Protocols and Long-Term Deficits

Caroline Carter
Faculty Mentor: Dr. Jennifer Tourville

University of Tennessee, Knoxville
Nursing

Neonatal Abstinence Syndrome (NAS) is a form of withdrawal in neonates caused by substance abuse during pregnancy and the abrupt discontinuation after birth, requiring treatment in a Neonatal Intensive Care Unit (NICU). The incidence of NAS increases tenfold annually in Tennessee, resulting in an alarming number of infants requiring NICU care and frequent follow-up assessments for long-term deficits during early childhood. To improve the health of neonates diagnosed with NAS, treatment protocols and long-term complications should be investigated. A literature review using a PubMed search with the keywords "Neonatal Abstinence Syndrome," "treatment protocol," and "follow-up care" yielded fifty journal articles. After synthesizing these articles, it was found that although most NICUs utilize the same medications to treat NAS, there is a lack of a standardized approach to medication weaning resulting in various lengths of NICU stay. Another identified gap in the research is a lack of standardized or required follow-up care for infants discharged from the NICU following NAS treatment. Further research could identify an effective treatment regimen that could decrease the NICU length of stay and optimize neonatal outcomes. Additionally, a regulated follow up process may assist with early diagnosis and interventions for long-term NAS complications.

Barriers to Mental Health Screening in Rural Adolescents

Caitlin Cartwright
Faculty Mentor: Dr. Amanda Harper

University of Tennessee, Knoxville
Nursing

Adolescent mental health is a growing concern in today's world. Yet, adolescents are not routinely screened for mental health disorders. Healthy People 2020 addresses this concern and the need for increased levels of screening. Additional disparities exist for rural adolescents as compared to their suburban and urban counterparts. Rural youth are shown to have higher rates of depression when compared to their urban and suburban counterparts. Furthermore, the suicide rates among rural adolescents in some parts of the country are twice as high as the rates of adolescents in urban areas. Literature from the past 11 years was reviewed, highlighting the additional barriers rural adolescents face to being screened. These highlights include physician training and beliefs, limited access to screening services, and personal beliefs of guardians and society. A gap evident in literature is the role of rural school nurses in the screening of students for mental health disorders. Rural school nurses face barriers that prevent them from properly and adequately screening students. These barriers include education, resources, and lack of time. Future research will explore rural school nurses' opinions about barriers that prevent them from screening students. In addition, research will uncover what rural school nurses feel can be done to address these barriers. Data gained from this study may help discover rural school nurses' needs and allow these needs to be addressed in order to increase the number of adolescents screened for mental health disorders.

Acute Social Defeat Stress Induces Microglial Activation in Key Limbic Regions

Thomas Clarity

Faculty Mentors: Dr. Matthew Cooper & J. Alex Grizzell

University of Tennessee, Knoxville

Neuroscience

Research suggests a causal relationship between neuroinflammation and stress-related psychopathologies. Exposure to moderate psychological stress in rodent models leads to elevated markers of immune activity in the brain, for example, microglia. Research has shown that tail shock stress can prime the subsequent, immune-challenged activation of microglia, which can lead to a degradative, proinflammatory response. Although social defeat is an ethologically relevant model of acute stress, there has been little research investigating the effects of acute social defeat stress on immune activity. Here, we used an acute social defeat paradigm in Syrian hamsters consisting of three, 5-minute aggressive encounters in the home cage of a three, novel resident aggressors. Then, 24-hours following social defeat, the effects of stress-induced priming of microglial activation was assessed by exposure to an endotoxin immune challenge via intraperitoneal injection of lipopolysaccharide (LPS). Four hours after injection, hamsters were euthanized and the activation of microglia was determined via immunolabeling of the ionized calcium-binding adaptor protein-1 (Iba-1), a marker that is expressed in activated microglia. Preliminary data suggest that LPS injection leads to increased Iba-1 immunoreactivity both in the presence and absence of social defeat stress in the ventral medial prefrontal cortex and dorsal raphe nucleus. Interestingly, acute social defeat also led to the activation of microglia in these regions in the absence of an LPS injection. Furthermore, it appears that all defeated animals, regardless of LPS treatment, maintain microglia activation as much as 9 days following defeat. Taken together, these results demonstrate that acute stress can activate innate immune mechanisms in key brain areas for stress processing, which extends our understanding of cellular mechanisms controlling responses to trauma.

Determining and Modeling the Residence Time Distribution of Biomass Particles in a Bench-scale Bubbling Fluidized Bed Reactor

Benjamin Cruz

Faculty Mentor: Dr. Nourredine Abdoulmoumine

University of Tennessee, Knoxville

Biosystems Engineering

Fluidized bed reactors are frequently used during biomass fast pyrolysis to produce primarily a dark organic liquid known as bio-oil or biocrude. In the process, the raw biomass is converted to a solid residue, biochar, and non-condensable gases. While the gas residence time of vapors during biomass fast pyrolysis is well investigated, the residence time distributions of solids are seldom studied. Yet, knowledge of the residence time of different biomass particles under various operating conditions is essential to accurately model the pyrolysis kinetic process and the heat-transfer characteristics of the system.

In this study, we propose to investigate the residence time distribution (RTD) in a bench-scale bubbling fluidized bed reactor using pine biochar at different devolatilization stages during fast pyrolysis. The flow of solid biochar materials will be monitored using an acoustic sensor, and the resulting signal will be processed to derive RTD curves. RTD curves will be further analyzed to determine the effect that experimental parameters have on the non-ideal biochar flow patterns within the fluidized bed.

The Voices of Photos: Transition to Adulthood in Lower Income Emerging Adults with Type I Diabetes Mellitus

Michael Curtis Jr.
Faculty Mentor: Dr. S. Abdoli

University of Tennessee, Knoxville
Nursing

Emerging adulthood (18-30 years old) is a vital, constructive period presented by exploration, experimentation, and risk-taking. Emerging adults with Type 1 Diabetes Mellitus (T1DM), face unique challenges managing their illness due to the additional daily demands of diabetes care and navigating the life transitions of adulthood. Diabetes management can be more challenging for low-income emerging adults with T1DM living in Appalachia, an underserved area. This can place them at an increased risk for poor glycemic control, emergence of chronic diabetes complications, and premature mortality. However, there is a lack of science particularly about the experience of low-income emerging Appalachian adults with T1DM during transition to adulthood. Understanding the experience of this marginalized population will inform future empowerment interventions. This study will use photovoice, an innovative qualitative and participatory research to explore the challenges of lower income emerging adults with T1DM during transition to adulthood. Photovoice this study will entail putting camera in the hands of low-income emerging adults with T1DM in Appalachian Tennessee, and asking them to visually present their challenges in diabetes management during transition to adulthood. It may help health care providers appreciate an emerging adult's personal experience about their transition to adulthood.

America's Oblivion: Preservation in the Age of Erasure

William Dunn

Faculty Mentor: Dr. Jennifer Akerman

University of Tennessee, Knoxville

Architecture

America's racial heritage, a crucial component of the nation's identity, has fallen to a condition of pervasive forgetfulness exacerbated by the strains of modernity and memory erasure. The increasing speed of travel renders historical markers and plaques obsolete, their elucidating texts consigned to a blur on a highway. The unprecedented size of the internet offers unparalleled access to data while also burying critical moments of American history with a barrage of sensory stimulation. With the growing speed and scale of the human experience, remembrance becomes the exception against the increasing collective forgetfulness, or oblivion. This project explores the ways in which architecture and infrastructure can help curate this oblivion by addressing America's legacy of racial terrorism and violence.

America's Oblivion is not entirely incidental. Whether it is the exclusion of the Japanese-American Internment from 20th-century history books or the discrepancy between the number of monuments honoring the confederacy and those remembering racial oppression, the role of race in American culture is systematically subdued at every opportunity. Contrasting this with other countries' thoughtful responses to national tragedies, especially within the context of the recent racial atrocities within the United States, America's need for memory-attuned infrastructure is clear. So, what is the architect's role in curating America's legacy of racial terrorism?

Above all else, architects are engineers of experiences. Experiences are essential to the creation of individual memories, and the amalgamation of individual memories generates and sustains culture. This places architects at a key moment of intervention in the maintenance of culture. This project seeks to answer fundamental questions such as: How can architecture recover forgotten moments to sustain culture? In what ways can design use the increasing speed of transportation and data against itself to create moments of pause that stand out against the pervasive background of oblivion? Under what circumstances is oblivion a positive condition? Questions such as these are gaining relevance in the contemporary architectural discourse and will shape America's public spaces in the coming decades. In response, this project posits both normative and speculative architectural and infrastructural responses to issues presented by America's Oblivion.

Stigma in Persons with Mild Cognitive Impairment and their Caregivers

Brianna Fiala
Faculty Mentor: Dr. Karen Rose

University of Tennessee, Knoxville
Nursing

Over 5 million Americans are living with Alzheimer's disease and related disorders (ADRD) today; 15 to 20% of people 65 years or older also have mild cognitive impairment (MCI), often a precursor to ADRD. One of the major issues that persons with ADRD and their family caregivers encounter is stigma. Stigma may influence their decisions to access care or make use of resources that are designed for support. However, it is unknown if stigma is experienced in persons with MCI and in their family caregivers. Thus, the purpose of this study is to describe stigma in persons with MCI and in their family caregivers. The design of this study is multiple methods. Quantitative data will be obtained using the stigma impact scale, CES-D to measure depressive symptoms, and the 18- item rating anxiety in dementia (RAID) scale to measure anxiety. Qualitative data will be obtained via individual study participant interviews to gain in-depth knowledge regarding perceptions of stigma in those persons with MCI and their family caregivers. Audio-recorded interviews will be transcribed and placed in NVivo software for analysis. Themes from the interviews will be identified. There are no study findings yet as this is an ongoing study. Results from this study will be target interventions to reduce stigma in persons with MCI and their caregivers.

Spying to Decode Mouse Maternal Behavior

Izabella Nill Gomez

Faculty Mentor: Dr. Keerthi Krishnan

University of Tennessee, Knoxville

Neuroscience

We have previously established that an aspect of learned maternal behavior, pup retrieval, is impaired in female mouse model of Rett Syndrome (Krishnan et al, Nature Communications, 2017). Rett Syndrome is a neurodevelopmental disorder, like Autism spectrum disorder, that mainly affects girls. This syndromic disorder is characterized by sustained sensory, cognitive, and motor deficits after an early postnatal period of normal development. Mutations in MECP2, an X-linked gene, predominantly cause Rett Syndrome. Most of the studies done to date are on male mouse models of Rett Syndrome, which have severe motor deficits and shorter life span. It is becoming increasingly difficult to transfer knowledge gained from studies in males to females, due to the emerging neurobiological and molecular differences between the sexes. How learning takes place in the adults and how it might be impaired in *Mecp2* hets is unknown. In this project, I monitored the interactions between the adults and the pups using 24-hour video and audio recordings, and during pup retrieval behavior tests. We aim to discover if these mice interact and learn maternal behavior through physical interactions and vocalizations. I analyzed behaviors such as nesting, grooming and play between adults and pups. The results from this project will fill crucial gaps in adult learning during maternal behavior.

Effects of Alcohol on Defeat-induced Social Avoidance in Mice

Emily Graham

Faculty Mentor: Dr. Matthew Cooper

University of Tennessee, Knoxville

Neuroscience

Studying the effects of alcohol consumption on stress resilience is an important step towards understanding the comorbidity of alcohol abuse and Post-Traumatic Stress Disorder. Based on former stress models in rodents, it is apparent that social defeat induces social avoidance in mice. The objective of this study was to investigate how alcohol consumption of mice affects social avoidance. There were four groups studied in this experiment. Two sets of mice were socially defeated and one cohort was provided ethanol while the other was given water. Two other sets of mice were not socially defeated and one subset was provided ethanol, while the other was given water. The mice were tested for two five minute back to back trials, once with an empty, plastic perforated box and then immediately after with a mouse in the plastic perforated box. The mice were tested once every seven days for three weeks. We determined that social defeat causes the mice to spend significantly less time exhibiting social behavior than the non socially defeated mice. The data provides that mice that were socially defeated and drank alcohol did not gain resilience to the social stress, while the socially defeated mice that drank water did gain resilience over the course of three weeks. We also found that there is a trend that alcohol decreases the amount of time that the mice actively avoid socializing at the extreme. These findings suggest that alcohol consumption does affect the social tendencies of the mice. This research also improves the current understanding of alcohol on stress resilience in mice, which could in turn aid knowledge on stress-related psychopathologies.

The Enzymatic and Geochemical Properties of Bone

Emily Grimes

Faculty Mentor: Dr. Jennifer DeBruyn & Dr. Sarah Lebeis

University of Tennessee, Knoxville

Microbiology

The study of the decomposition of bones in the environment-or bone taphonomy-has important implications for paleontology and forensic science. There have been studies that have documented the taphonomy of bones, the variation of the quantity and quality of human DNA found within different skeletal elements, and variations among the microbial communities within different bones. These studies show that microbes inhabit bones and are presumably playing a role in their decay, however there have not been any studies detailing the functional (i.e., enzymatic) activity of microbes in bones and how they may affect the composition of bone. The objective of this research is to determine the variability in microbial activity and bone chemistry between different skeletal elements of naturally-decomposed vertebrates.

My hypothesis is that microbes are modifying bone chemistry and there will be a correlation between microbial enzyme activity and bone chemistry. The research is being conducted using the North American beaver (*Castor canadensis*). We examined approximately 30 bones from each of three beavers, which decomposed naturally on the soil surface in a Southeastern United States mixed deciduous forest. Variation in microbial enzyme activity was determined using a modified assay for potential collagenase activity. For bone chemistry, Fourier-transform infrared (FTIR) spectroscopy was used to provide insight into crystallinity, carbonate, phosphate, and organic content. Ultimately, the goal of this study is to test whether microbial activity is correlated to bone chemistry. Thus far, the data obtained from the enzyme assay indicate that certain areas of the skeletal system have more collagenase activity than other areas, particularly the ribs. One beaver (a mature adult with fully-fused sutures), did not have any bones with positive collagenase activity, suggesting that the ability of microbes to access bone may be partly controlled by bone maturity. FTIR data highlighted some differences in crystallinity, amide content, weight percent organic matter, carbonate/phosphate ratio, and carbonate content between different regions of the skeleton, but not between individuals. Further studies of bone taphonomy after longer exposure to environmental conditions may display more significant changes to microbial colonization and enzyme activity and/or bone chemistry.

Tennessee Junior 4-H Camp Curriculum: Creating, Implementing, and Evaluating Educational Programming Using Research-Based Practices in Youth Development and Instructional Design

Alexis Hall

Faculty Mentors: Dr. Jennifer Richards

University of Tennessee, Knoxville

Psychology

This project shows the process of creating, implementing, and evaluating an interdisciplinary curriculum for junior 4-H camp at the University of Tennessee Extension Clyde Austin 4-H Center in Greeneville, Tennessee. Four lessons were developed using research-based practices in experiential learning and instructional design, including the Richards Working Model of Curriculum Development and Robert Gagne's method of instructional design.

During the summer camping season of 2017, 1,184 students learned about Tennessee history and life skills while developing their skills in art, music, science, math, and language arts at 4-H camp. Campers in grades 4-6 learned about Sequoyah's invention of the Cherokee syllabary, endangered species in the Great Smoky Mountains National Park, Pat Summitt's leadership as the head coach of the Tennessee Lady Volunteers Basketball team, and the history reflected in the state songs of Tennessee.

Responses from camper evaluations indicate 54% of the sampled population learned from the curriculum, and evaluations from volunteer leaders and 4-H agents indicated frustration with various aspects of the educational sessions. This feedback and practitioner reflections guide recommendations for future curricula.

The Psychosocial Responses to and Decision Making Strategies of Hereditary Cancer Genetic Panel Testing

Gillian Harris

Faculty Mentor: Dr. Sadie Hutson

University of Tennessee, Knoxville

Nursing

Cancer genetic testing (CGT) is a powerful diagnostic test that improves prevention and early detection of individuals at high genetic risk of cancer. Since the completion of the mapping of the Human Genome Project, CGT has become increasingly accessible in the clinical setting. However, as gene discovery and sequencing technology improves, the impact of these advancements on patients is less understood. The use of multi-gene cancer gene panel tests has become increasingly more prevalent; as such, the likelihood of incidental or inconclusive findings has increased. This can cause confusion among patients. The author conducted a literature review to outline the science on cancer genetic testing methods, the psychosocial responses to testing among patients, and the unique role of nurses in this process. Forty-six references were identified via PubMed and CINAHL databases using the keywords “genetic testing,” “panel testing,” “genetic counseling,” “psychosocial oncology,” and “women.” A significant gap in the literature exists regarding multi-gene cancer genetic panel tests and the associated experiences and decision-making processes among individuals who have had testing. Future research will specifically explore the experiences of young women with breast cancer who have undergone hereditary cancer risk assessment genetic panel testing that reveals incidental or inconclusive findings.

Needs and Concerns of Individuals in the Medicaid Gap

Meredith Hudson
Faculty Mentor: Dr. Carole Myers

University of Tennessee, Knoxville
Nursing

One goal of the Affordable Care Act (ACA), signed into law in 2010, was to provide health-care coverage to as many Americans as possible. Indeed, more Americans than ever have access to some kind of health coverage. However, over 163,000 Tennesseans are currently without health insurance because of the state's decision not to expand Medicaid, an optional provision of the ACA. These Tennesseans are stuck in what is referred to as the Medicaid Gap. They do not qualify for Medicaid based on their income level. These same people would qualify if the state elected to expand Medicaid. The purpose of this study is to describe the perspectives and experiences of Tennessee adults who have been in the Medicaid Gap for at least six consecutive months. Personal interviews with adults in the Medicaid Gap will be used to gain in-depth knowledge regarding experiences related to healthcare access. Recordings of interviews will be analyzed by the Honors student and faculty mentor. Themes from the interviews will be derived from the interview data. Results from this study may be utilized to inform public policy regarding healthcare access and utilization.

Implementing Social Support Towards College Freshmen's Nutritional Habits

Elle Johnson

Faculty Mentor: Dr. Laura Miller

University of Tennessee, Knoxville

College Scholars: Health Communication and Promotion

Based on the trope of the “Freshman 15,” nutrition is a prevalent issue for college freshmen that can have short-term and long-term consequences. Evidence indicates that social support is a valuable communicative tool for supporting nutrition, but little research has been conducted on the vulnerable college freshmen population. The present investigation seeks to explore the current role that social support plays in college freshmen eating habits, where freshmen are receiving this support and what barriers exist to giving or receiving social support in the college setting. In-depth interviews with 30 college freshmen were conducted to explore the role of social support in encouraging student nutrition. A constant comparative analytic method, including grounded theory techniques, was used to analyze the qualitative data in order to better organize and synthesize the prominent emergent themes. The results indicate that college freshmen receive unique forms of social support from both parental and peer sources that influence their overall nutrition outcomes. However, despite positive intentions, some forms of social support regarding nutrition are perceived by college freshmen as being unproductive and unhelpful, affecting their willingness to seek support when needed. Implications of these findings for supporting healthy communication with college freshmen and identifying possible outlets for university programming and policies will be discussed.

Role of Healthcare Providers in Combating Sex Trafficking in Knoxville, Tennessee

Avie Joyce & Stefanie Schumacher
Faculty Mentor: Dr. Maria Hurt

University of Tennessee, Knoxville
Nursing

Sex trafficking is a public health issue recognized as a human rights violation occurring worldwide, including in the United States. Although Knoxville, Tennessee, has been identified as a hub for sex trafficking with the crossing of Interstate 40 and Interstate 75 downtown, there is very little literature that focuses on sex-trafficked victims specific to this region. Studies have shown that the majority of victims in the United States have at some point while being trafficked come in contact with healthcare providers. The objective of the literature review was to determine characteristics of sex trafficking victims that could aid in their identification and plan for care by health care providers. The literature was reviewed utilizing PubMed and CINAHL databases using the search terms “human trafficking”, “modern slavery”, “prostitution”, and “sex trafficking”. Common themes included: trauma, stigma and societal influences associated with sex-trafficked victims, coerciveness of pimps and Safe Harbor Laws. Extensive gaps in the literature include best methods for identification and care of sex trafficking victims and their immediate and long-term needs. The intention for our research is to identify available local resources for victims and survivors and utilize this information to create educational materials and trainings for local healthcare providers.

Analyzing the Efficiency of a Metropolis Monte Carlo Simulation for a 2D Ising Spin Lattice

Kevin Kleiner

Faculty Mentor: Dr. Steve Johnston

University of Tennessee, Knoxville

Physics and Mathematics

Monte Carlo programs can simulate the stochastic behavior of many-body atomic systems over time and reproduce the system's observable electrical and magnetic properties. This numerical simulation was implemented for a square Ising lattice of interacting atomic spins to collect independent measurements of the crystal's magnetization at varying times. The simulation ran for the ferromagnetic phase (ordered spin directions) and paramagnetic phase (unordered spin directions) with the boundary dictated by a critical temperature. Due to the stochastic updating algorithm for the spin sites, one system state was strongly correlated with the next state. To retain the validity of the magnetization average and variance calculations and minimize their bias, the simulation needed to only collect data when the states were nearly uncorrelated. Autocorrelation analyses gave insight into the amount of correlation between one site's spin value and that same site's spin value a certain time later. Evidently, the time steps required for the 30x30 (dimensions in site numbers) lattice's spin autocorrelation to drop below 10% ranged from 20 steps when far from the critical temperature to 200 steps when very close to the critical temperature. This slowing effect was compounded with larger system sizes since the Metropolis spin flip proposal algorithm was needed for more sites. The next step to improve the Monte Carlo simulation efficiency is to train a neural network to more quickly calculate the probabilities of flipping spins on the lattice.

The Experience of Access to Care Among Persons with a Low Family Income

Malerie Lazar
Faculty Mentor: Dr. Lisa Davenport

University of Tennessee, Knoxville
Nursing

Low family income presents a wide variety of problems for men and women seeking access to health care. Health care disparities among persons with a low family income (PLFI) continues to be one of the most complex and prevalent problems, particularly for rural America. Many barriers exist for PLFI who seek access to adequate health care in the United States (U.S.). A review of literature revealed common barriers to primary care to be a lack of education, complications with health insurance, and personal distrust of health care providers. Acknowledging the substantial barriers that prevent access to routine health care for PLFI is the first step towards determining future sustainable solutions. A gap in the literature indicates the voice of low-income persons and the meaning of access to care for them is unheard. Future research will examine the meaning of access to care to PLFI in order to provide insight to how healthcare providers can effectively assist those who are in need. A phenomenological approach will be used to explore the essence of the experience and meaning of access to care for those who receive services of non-profit medical organization clinics (such as Remote Area Medical Clinic), which becomes a typical source of care for low-income persons.

Sex Differences in the Effects of Social Status on Defeat-induced Social Avoidance in Syrian Hamsters

Annie Loewen

Faculty Mentor: Dr. Matthew Cooper

University of Tennessee, Knoxville
Neuroscience and Psychology

Understanding the neuroendocrine mechanisms that support stress resilience is an early step toward developing more effective treatment options for patients who suffer from stress-related psychopathologies. Although social defeat models in male rodents are frequently used to investigate the cellular mechanisms of stress susceptibility, much less research has included females. We have previously shown that male Syrian hamsters exhibit elevated social avoidance following acute social defeat stress. Interestingly, male hamsters with dominant social status exhibit elevated plasma testosterone, increased androgen receptor expression in the medial amygdala (MeA) and ventral lateral septum (vLS), and less defeat-induced social avoidance compared to subordinates and controls. The objective of this study was to investigate whether dominant female hamsters show changes in testosterone concentration, androgen receptor expression, and defeat-induced social avoidance. Adult female hamsters were matched according to their estrous cycle and paired in 12 daily social encounters to establish dominance relationships. To avoid dyadic encounters when females were in estrous, we skipped encounters every 4 days. Male hamsters were similarly paired in dominant/subordinate dyads for 12 days. Blood was collected from both male and female subjects prior to and 15 min following their first dominance encounter. After the final dominance encounter, animals experienced acute social defeat stress and 24 hours later received a social interaction test with a same-sex, unfamiliar, confined hamster. While acute social defeat stress produced social avoidance in both male and female hamsters, social status altered social avoidance and plasma testosterone in males but not females. Whether social status alters the expression of androgen and estrogen receptors in the MeA and vLS will also be addressed. These findings suggest the neuroendocrine mechanisms controlling the effects of social status on defeat-induced changes in behavior in male hamsters do not generalize to female hamsters. This line of research improves our understanding of the neuroendocrine mechanisms regulating sex differences in vulnerability to stress-related mental illness.

The Importance of Baseline Analysis for Establishing Replicable, Evidence-Based Behavior Analytic Interventions: Implications for Researchers and Practitioners

Angel Lunceford

Faculty Mentor: Dr. James Fox from ETSU

East Tennessee State University

Microbiology

Single subject studies analyze individual behavior identifying how interventions change behavior. Critical to this analysis are repeated baseline measures to identify behavior function and evaluate intervention effects. 40 studies treating child behavior problems between 1997 and 2015 were analyzed. Average student age was 8 years. Most studies used simple frequency counts (47%) of behavior. Baseline observation averaged 42 minutes and 7.4 observations. Most studies (81%) reported no systematic analysis of baseline stability, making it difficult to establish evidence-based effective interventions.

Elucidating the Effects of a High Fat Diet on In-Vitro Nanoparticle Internalization

Sidharth Mahajan
Faculty Mentor: Dr. Paul Dalhaimer

University of Tennessee, Knoxville
Chemical and Biomolecular Engineering

My goal is to determine how diets with varying amounts of fat affect the ability of macrophages to clear foreign objects in vivo. I am using polymeric nanoparticles in vitro as a model system. In particular, functionalized polymeric nanoparticles have shown promise as potential drug delivery vehicles, but the ability of immune response cells – especially macrophages – to clear them has yet to be determined. This research study utilizes lipotoxicity assays to assess the ability of pro- and anti-inflammatory macrophages to phagocytose various nanoparticle chemistries in vitro. After loading nanoparticles with fluorescent dye and utilizing fluorescent microscopy to observe colocalization, there could be a significant difference in nanoparticle internalization based on the amount of fatty acid in the macrophage diet and the nanoparticle chemistry. The results will also provide evidence for further investigation into which nanoparticle chemistries are best suited for high fat diets. If these results hold true for an in vitro mice model, there should be a significant difference in nanoparticle biodistribution between obese and healthy mice. On a larger scale, the results from this study will provide a deeper insight as to whether or not polymeric nanoparticles can eventually be used for targeted medicinal purposes in obese and diabetic patients.

Robust and Cost Efficient Method for Fabrication of Tungsten Tips for Scanning Tunneling Microscopy

Bahar Meshkat

Faculty Mentors: Dr. Bamin Khomami & Dr. Hanieh Niroomand

University of Tennessee, Knoxville

Biochemistry and Molecular Biology

The quest for green energy has sparked considerable interest in plant biology, specifically in Photosystem I. PSI is the photosynthetic protein complex that acts as a nano-scale biological photodiode and allows for light-activated charge separation to facilitate unidirectional electron flow. This light-activated charge separation has nearly 100% quantum efficiency. The structural and photo-electrochemical properties of PSI allow it to be suitable for incorporation into bio-electronic or hybrid photochemical devices. Prior to this advancement, the first step towards the rational design of such revolutionary devices requires a fundamental understanding of the morphological and electronic properties of PSI on various donor substrates/electrodes. This aspect sparked the interest of STM research. Scanning Tunneling Microscopy (STM) is a powerful scanning-probe technique that allows simultaneous high-resolution analysis of localized topography and charge transport properties of at atomistic resolution. To this end, preparation of quality STM tips is critical in acquiring high quality images and in turn tunneling current of PSI nanostructures. Such demand for high-precision STM tips has launched the exploration of many techniques used to produce STM tips with uniform and controlled tip radius and geometry. These multiple methods are marked by distinct parameters which demand highly specific configurations. Our highly developed method in particular, facilitated by electrochemical (EC) etching of tungsten wire, allows the creation of sharp and clean STM tips via judicious selection of the process parameters. This method takes into account the chemical and physical properties of tungsten wire to create consistent replicates of STM tips. The tips are prepared, etched, and insulated with particular methods. In this presentation an overview of our novel device that produces robust, efficient tips that provide the design and operation of our affordable, cutting-edge alternative to costly manufacturing of STM tips will be discussed.

Synthesis of Ruddlesden-Popper Strontium Iridate Epitaxial Thin Films

Peyton Nanney
Faculty Mentor: Dr. Jian Liu

University of Tennessee, Knoxville
Physics

We investigated the growth conditions conducive to synthesize Ruddlesden-Popper type SrIrO_3 , Sr_2IrO_4 , and $\text{Sr}_3\text{Ir}_2\text{O}_{13}$ epitaxial thin films via pulsed laser deposition (PLD). Many factors influence the thermodynamic interactions of the deposition and therefore, determines the material phase that is created. Through a systematic review of these growth conditions, we constructed a growth phase diagram that maps out conditions that enable stable formation of strontium iridate phases. We synthesized these phases with a single Sr_2IrO_4 target with varying the O_2 chamber pressure and the substrate temperature. These films allow for the analysis of magnetic properties of the material through vibrating sample magnetometry and other methods. Our findings demonstrate the control of the thermodynamic stability of different epitaxial layered structure of the complex Ruddlesden-Popper family.

A Comparison & Discussion of Concussion Protocols for Youth in Tennessee

Corinne Oliphant

Faculty Mentor: Dr. Robin Hardin & Mr. Jim Bemiller

University of Tennessee, Knoxville

Business Management and International Business

Nearly 4 million people experience Concussions and Chronic Traumatic Encephalopathy (CTE) each year in the United States (TBI: Get the Facts, 2017). The focus of this research is to examine concussion policy and protocol for pay-for-play sports and club facilities. This study also explores where the standard of care for concussions is derived for private pay-for-play sports and club facilities. Concussion standard of laws exist in nearly every state and has regulated all public facilities. The question remains if private facilities follow this law, and if they do, how they meet, or fail to meet, the standards the law provides. The research methodology consists of interviews with general managers, coaches, and/or employees of private sports and club facilities as well as a review of varying private facilities concussion protocol and training methods.

Novel Methods in Direct-Write Additive Manufacturing

Liam Page

Faculty Mentor: Dr. Brett G. Compton

University of Tennessee, Knoxville

Engineering: Reliability and Maintainability

Direct-Write printing utilizes extrusion to deposit viscoelastic feedstock materials to build structural or functional components. A wide variety of powder-based inks and polymer composites can be formulated for this method using powders, solvents, dispersants, viscosifying agents and polymer binders. The printing process is material-agnostic, provided the ink formulation exhibits favorable rheological properties. However, these materials are currently limited to 1-part systems and offer no control over fiber orientation. Greater control over final material properties could be achieved through the design and manufacture of novel mechanical devices tailored to address these constraints. Through this research we have explored two separate methods and begun to develop two novel dispensing systems. An active mixing nozzle (AMN) for 2-part materials systems with fast cure times as well as a rotating deposition nozzle (RDN) for control over fiber orientation have been developed and tested throughout this research.

Potential Contamination Risk in Tennessee Aquifers from Oil and Gas Drilling

Emma Reed
Faculty Mentor: Dr. Liem Tran

University of Tennessee, Knoxville
Geography

The practice of drilling for oil and gas raises environmental concerns for potable drinking sources such as underground aquifers since contamination is an associated risk. About 16,000 oil and/or gas well permits are in existence in the state of Tennessee, according to public record. A large portion of the permits date back to as early as the 1960's while others pre-date state regulations requiring permits. The question of whether older wells introduce a greater risk of contamination is up to debate. Therefore, the objective of this research is to qualitatively assess the potential risk of contamination in Tennessee aquifers due to oil and natural gas drilling using temporal and spatial characteristics. This study uses public records that provide information on the wells' location, purpose, and depth. The dates and statuses of the well permits are taken in account to determine which aquifers are at risk for contamination due to dated equipment, improper or defective sealing, poor management, etc. Using Esri's ArcMap software, the study analyzes the density of in-operation, pre-permit, plugged, and abandoned wells within each county to determine the relative risk of contamination. This information may help manage and regulate old or abandoned wells by prioritizing those that pose a greater risk to groundwater supplies. Also, this information may be presented to governmental agencies to address the issue of missing data, and provide them with valuable insight into the practice of oil and gas drilling.

Evaluating a Novel Music Program Experience for Community-Residing Older Adults

Jordan Riggins

Faculty Mentor: Dr. Susan McLennon

University of Tennessee, Knoxville
Nursing

Older adults in the community frequently suffer from psychological and physiological health issues at higher rates than the general population. Some research has found leisure activities, including music therapy, to be effective in improving various health outcomes in this group. However, optimal types and delivery methods for interventions remain unclear. A literature search was conducted in CINAHL and PubMed databases using keywords music therapy, leisure activities, older adults, and psychological and physiological health in various combinations. Sixteen articles met inclusion criteria. Findings indicated that group activities were advantageous by providing an environment to foster peer relationships with peers. Immersive interventions such as listening and focusing on the music, were therapeutic for cognitive and psychological benefits. Other leisure, sedentary activities (ex. Games, BINGO) contributed to more positive psychological and physical health perceptions in community-residing older adults. The potential for a new, novel game, SINGO, which combines music with a popular leisure activity, BINGO, will be tested in community residing older adults. State emotional status, perceived health, and demographic data will be evaluated before and after the intervention.

Overexpression of *Thioglucoside Glucohydrolase 1* (TGG1) Affects Intercellular Trafficking in *Arabidopsis thaliana*

Alessandro Sarno

Faculty Mentor: Dr. Tessa Burch-Smith

University of Tennessee, Knoxville

Kinesiology

Plasmodesmata (PD) are pores that traverse plant cell walls, providing a route for intercellular trafficking of essential metabolites, nutrients, and signaling molecules between adjacent plant cells, thereby aiding communication. The increased size exclusion limit 2 (*ise2*) mutant of *Arabidopsis thaliana* has an increased abundance of branched PD, as well as a greater flux of intercellular trafficking. A search for proteins that interact with ISE2 identified *Thioglucoside Glucohydrolase 2* (a myrosinase). *A. thaliana* also encodes a second, closely-related myrosinase, TGG1. Myrosinases are enzymes that catalyze the hydrolysis of glucosinolates, a type of secondary metabolite that are amino acid derivatives. The breakdown of glucosinolates by myrosinases and related enzymes produces isothiocyanates, toxic compounds important for plant defense. While ISE2 and TGG2 interact, the effects of this interaction are unclear, and understanding this relationship was the goal of this study. We measured intercellular trafficking of green fluorescent protein (GFP) in plants with constitutive strong expression of TGG1. Intercellular trafficking decreased in plants with increased TGG1 expression. This result suggests that TGG1, and probably its substrates or products, could have important roles in controlling intercellular trafficking via PD. We will also explore how this decrease in intercellular trafficking affects plant defense.

Increasing HPV Vaccination Rates Among College-Aged Males

Austin Smith

Faculty Mentor: Dr. Tamara Bland

University of Tennessee, Knoxville

Nursing

In 2009, the Human Papillomavirus vaccine, commonly known as Gardasil, was approved by the CDC for use in the U.S. male population. This recommendation came only three years after the approval of the vaccine in females. Vaccine rates among college-aged males, however, remain much lower than the rates of their female counterparts. The objective of this review is to identify factors that lead to this discrepancy in the college-aged male population. A systematic review of literature was conducted with CINAHL and PubMed using the terms: "HPV," "male," "college," "vaccination," "barrier," and "STI." The articles that were reviewed attribute the current HPV vaccination rates to healthcare barriers, knowledge deficits among target populations, and the methods by which HPV-related information is communicated to patients. Weakening these barriers, increasing general vaccine knowledge, and improving methods of relaying vaccine information are promising ways to increase vaccine uptake. This increase in HPV vaccination will decrease transmission of the virus, incidence of HPV infection, and subsequent pathologies (i.e. cervical cancer, genital warts, etc.). More research is needed in order to identify specific interventions that are effective in increasing the willingness of unvaccinated males to begin the vaccination series during their time in college.

Parental knowledge of Adverse Childhood Events and their effect on health and substance abuse disorders

Chelsea Smith

Faculty Mentor: Dr. Sharon Davis

University of Tennessee, Knoxville

Biochemistry, Cellular and Molecular Biology

Events in a child's life, whether positive or negative, can have a deep, lasting impact. Adverse Childhood Experiences (ACE) are any "stressful or traumatic" event experienced during childhood. This SAMHSA definition encompasses physical abuse, sexual abuse, emotional abuse, physical neglect, emotional neglect, mother being treated violently, substance misuse within household, household mental illness, parental separation or divorce, and an incarcerated household member. ACE are not uncommon events. A literature review was conducted using PubMed and CINHALL databases; the author identified a gap in literature involving parental knowledge about links between ACE and substance abuse. There is evidence connecting ACE to subsequent development of health problems, including substance use disorders. While research shows that early intervention and high levels of parental involvement may be the key to preventing substance use and mental health disorders, no evidence exists concerning parents' knowledge about ACE and their potential for lifelong effects. The specific gap being investigated is "What do parents know about the links between ACE and substance abuse and early intervention techniques to prevent substance abuse in the future?".

Emotion-Focused Coping Among Individuals with Fibromyalgia

Starla Smith

Faculty Mentor: Dr. Joel Anderson

University of Tennessee, Knoxville
Nursing

Fibromyalgia is a chronic pain disorder characterized by chronic widespread pain. It is an illness that includes not only widespread pain, but also fatigue, sleep disorders, neurological symptoms, impaired memory, and depressed mood. Coping is a term used to define how a person deals with a problem. Emotion-focused coping is a form of coping for individuals with fibromyalgia that addresses the toll a chronic illness can take on a person when the illness is permanent. The intended goal of emotion-focused coping is to reduce emotional stress.

A research project of qualitative design was done using five public blogs written by individuals with fibromyalgia. Using a qualitative thematic analysis, three reoccurring themes were identified : Emotion-Focused Coping Strategies, Priorities for Self Management, and Hobbies & Creative Expression. The subcategories for Emotional Coping Strategies are: Avoidance/Distraction, Positive Reappraisal, and Seeking Social Support. The subcategories for Priorities for Self Management are: Alleviating Symptoms, Mental Stressors, Spreading Awareness, and Self Identity. The subcategories for Hobbies & Creative Expression are: Writing, Reading, Visual Entertainment, and Social Outings.

By identifying what the primary concerns are for individuals with fibromyalgia and how they are coping with a chronic pain illness, this can potentially create awareness of these concerns and change healthcare practices to provide better holistic care for this patient population.

Recreated Culturally Acceptable Advance Directive for Persons Experiencing Homelessness

Whitney Stone

Faculty Mentor: Dr. Sandra Mixer

University of Tennessee, Knoxville
Nursing

Although the process of dying is a universal human experience, it often amplifies people's unique cultural differences. Persons experiencing homelessness (PEH) have unique barriers, challenges, and wishes for end of life care. There is insufficient evidence about providing culturally congruent advance care planning (ACP) and end-of-life care for PEH. This study addressed this knowledge gap and findings serve as the basis for developing additional strategies to promote a satisfying advance care planning experience by completing an advance directive (AD). The purpose of this study was to discover if a recreated AD for PEH would positively impact their completion of the AD as well as their overall experience with ACP. Guided by the culture care theory and qualitative ethnonursing methodology, 38 participants (30 persons experiencing homelessness and 8 student nurses) were interviewed. Data was analyzed using the four phases of ethnonursing analysis. Themes abstracted are; PEH feel that an AD "needs to be done," ACP can be facilitated through an AD workshop with student nurses, and the recreated AD was culturally acceptable for PEH. Recommended nursing interventions promote a dignified, meaningful ACP experience for vulnerable populations.

Empowering Women with Options for Labor Management

Madison Taylor
Faculty Mentor: Dr. Shelia L. Taylor

University of Tennessee, Knoxville
Nursing

Of the 353,000 babies born every day to laboring mothers, physical and psychological pain is an inevitable aspect of the birthing process that healthcare providers seek to combat with a wide variety of labor interventions. However, these women are often directed by these professionals to use drug-related interventions such as epidurals for pain management instead of being presented with all available alternatives, which detracts from the individualization of this process. Forty references were identified and amalgamated to construct a complete review of literature; PubMed and CINAHL databases were exploited using key words such as “non-pharmacological interventions,” “labor,” “women,” “pharmacological interventions,” “pain management,” and “stress.” Researchers indicate a beneficial relationship between numerous non-pharmacological interventions and the relief of physical pain as well as psychological and emotional stresses related to labor. Additionally, separate scientific studies demonstrate unfavorable, adverse effects epidurals elicit on women’s physical, psychological, and financial aspects of life. Identified as a significant gap in the literature is the lack of knowledge with regard to the interventions and their actual use for treatment of labor pain. Future research findings will continue to assess women’s knowledge, utilize these findings to educate about the variety of pain management options, and aid in determining which interventions is best for their individual labor experience. This will seek to improve outcomes related to physical and psychological pain levels that accompany labor.

3D Genome Organization During Neutrophil Migration

Peyton Terry

Faculty Mentor: Dr. Rachel Patton McCord

University of Tennessee, Knoxville

BCMB and Philosophy

The human genome is more than a mere code—it is a dynamic three-dimensional (3D) structure. The importance of 3D genome structure has been implicated in studies investigating cancer cell migration. To better characterize the 3D genome, we examined its physical role in the migration of a human cell line (HL-60) able to differentiate into neutrophil-like cells (HL-60d). Neutrophils are notable for their distinct lobular nuclei and migratory ability, providing an interesting model in which to study the 3D genome. In vivo, neutrophils must extravasate, or squeeze through tight junctions of blood vessels, to reach sites of infection. We hypothesized that neutrophil 3D genome structure is integral to successful extravasation. To mimic extravasation in vitro, we performed Transwell migration assays in which HL-60d cells must constrict their nuclei to migrate through small pores. We predicted that this constriction would affect the organization of the 3D genome, but after migration we found no significant change in the distribution of heterochromatin and euchromatin in the 3D genome as examined by immunofluorescence. We then perturbed the 3D genome with the histone deacetylase inhibitor (HDACi) drug trichostatin A (TSA), which has previously been shown to inhibit cancer cell migration. HDACi drugs increase histone acetylation, decondensing the chromatin within the nucleus. Preliminary results show that there is no significant difference in HL-60d migration after TSA treatment. These results taken together may indicate that neutrophil migratory ability, unlike cancer cell migratory ability, is extraordinarily robust to perturbation. Moving forward, we will attempt to explain this apparent difference by examining the post-migration changes in global genome accessibility and organization of HL-60d cells via the ATAC-seq and Hi-C techniques, respectively.

Nurse Perceptions of the Effects of Cuddling in Neonatal Abstinence Syndrome

Morgan Vantrease
Faculty Mentor: Dr. Deb Chyka

University of Tennessee, Knoxville
Nursing

The incidence of Neonatal Abstinence Syndrome (NAS) resulting from in-utero exposure to opioids has increased significantly in recent years and continues to grow globally. Treatment results in lengthy and costly Neonatal Intensive Care Unit (NICU) stays and, in areas with increased incidence such as Tennessee, the care needed to support these infants may exceed the availability of nursing staff. Pharmacological therapies are often needed to help infants with NAS withdraw safely. The author conducted a literature review to explore the use of non-pharmacological treatments for infants with NAS using PubMed and CINAHL. While there is mention of non-pharmacological therapies to console infants experiencing NAS, a gap exists in the science pertaining to effectiveness of such therapies on infants or the impact they have on nursing staff. Research regarding this gap will examine the effectiveness of one non-pharmacological intervention, cuddling of the neonate. The author will elicit the perceptions of nursing staff using electronic surveys to identify views of the intervention. This study will generate scientific data that can build the foundation for future research on non-pharmacological therapies in infants being treated for NAS in conjunction with previously collected data regarding physiologic effects of cuddling on neonates before and after cuddling. Data collection is being conducted at this time.

Olfactory Perception Behavior in *Drosophila melanogaster* (Fruit Fly)

Richard Vuong & Rachel Shah
Faculty Mentor: Dr. Jae H. Park

University of Tennessee, Knoxville
Neuroscience

Between the years 1988 and 2014, obesity rates among children ages 6-11 have increased by 54%, and extreme obesity by 20%. Obese children are more likely to develop negative health conditions later in life including hypertension, type 2 diabetes mellitus, and breathing problems. Evidence-based literature identifies school-based intervention programs as a promising environment to educate children on obesity while promoting healthy living decisions and decreasing negative health risks. A review of literature was conducted to further understand these programs and determine what, if any, interventions were being implemented to educate parents on their child's health behaviors. Keywords such as childhood obesity prevention, parent support, home environment, parental role modeling, and food-related parenting practices were searched in CINAHL and PubMed databases. One of 11 studies on after-school obesity prevention programs addressed parent engagement. Ten studies addressing childhood obesity conducted outside the school setting reported positive changes in children's health-related behaviors with parental role-modeling. Of the total literature reviewed, a gap exists concerning the integration of parental role-modeling as an effective approach for children's success in educational interventions of after-school obesity programs. Future research will focus on parental role-modeling using an educational intervention that addresses physical activity and healthier food practices in the home.

Parental Support in Home Environment for Children in a School-Based Obesity Program

Mary Wilson

Faculty Mentor: Dr. Lizanne Elliott

University of Tennessee, Knoxville
Nursing

Between the years 1988 and 2014, obesity rates among children ages 6-11 have increased by 54%, and extreme obesity by 20%. Obese children are more likely to develop negative health conditions later in life including hypertension, type 2 diabetes mellitus, and breathing problems. Evidence-based literature identifies school-based intervention programs as a promising environment to educate children on obesity while promoting healthy living decisions and decreasing negative health risks. A review of literature was conducted to further understand these programs and determine what, if any, interventions were being implemented to educate parents on their child's health behaviors. Keywords such as childhood obesity prevention, parent support, home environment, parental role modeling, and food-related parenting practices were searched in CINAHL and PubMed databases. One of 11 studies on after-school obesity prevention programs addressed parent engagement. Ten studies addressing childhood obesity conducted outside the school setting reported positive changes in children's health-related behaviors with parental role-modeling. Of the total literature reviewed, a gap exists concerning the integration of parental role-modeling as an effective approach for children's success in educational interventions of after-school obesity programs. Future research will focus on parental role-modeling using an educational intervention that addresses physical activity and healthier food practices in the home.

Understanding T Cell Movement in the Liver

Viktor Zenkov

Faculty Mentor: Dr. Vitaly Ganusov

University of Tennessee, Knoxville

Computer Science

Vaccine-induced T cells play an important role in combating malaria by eliminating the infection in the liver stage. However, given that there are millions of hepatocytes in a mouse liver and only a handful of these are infected, how T cells locate the infection site and eliminate the infection remains poorly understood. Are the T cells moving intentionally toward parasites, or simply randomly running into their prey? To answer this question, I used timed position data of malaria-specific T cells, non-specific control T cells, and a parasite, obtained from experiments in a mouse liver; I performed statistical analyses with the null hypothesis that the T cells move randomly. I used two metrics, based on distances from the parasite and turning angles by the T cells. The tests performed with these metrics did not suggest the same conclusions as each other, raising the question of which metric is more robust, if either. To investigate this, I visualized possible movements for a cell and found that by definition, the angle metric will define more cell movements as getting closer to the parasite than the distance metric will. Therefore, for statistical tests based on proportions, the angle metric will show more evidence of being attracted to the parasite than the distance metric. This inspired me to calculate the probability of a cell getting closer to the parasite as viewed from the distance metric, and it turned out to be less than the assumed 50 percent. With this discovery, I improved the null hypothesis' distribution. Applying this improvement to the original tests, the distance metric's test results became closer to the angle metric's test results. This development regarding the definition of random movement, which does not appear to have been used by prior researchers studying cell movement, gets us one step closer to accurately analyzing cell position data and then to understanding T cell movement.

