

Welcome to the 2019 Works in Progress Symposium

The Helen Hardin Honors College is proud to sponsor the 2019 Works in Progress Symposium. This annual event provides a means for undergraduate students throughout the University to share their research with the general University community, and recognizes the significant contribution to research by University of Memphis undergraduates.

Providing undergraduates with the opportunity to engage in scholarly research is important to our students' educational experience and professional development. I applaud all the faculty mentors for providing an exceptional learning experience for their students. Very special thanks are due to the faculty evaluators, who kindly provide feedback to the student presenters to better prepare their research projects for submission to professional conferences.

To the student presenters, congratulations for the quality research you have accomplished and for your participation in the Works in Progress Symposium. I hope you will consider submitting your research to *Quaesitum*, the University of Memphis undergraduate research journal.

Welcome to the Works in Progress Symposium. Best wishes to all faculty, staff, and students who make this event possible.

Sincerely,

A handwritten signature in black ink that reads "Melinda Jones". The signature is written in a cursive, flowing style.

Melinda Jones, Ph.D.
Director

Acknowledgments

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The Helen Hardin Honors College gratefully acknowledges the following faculty sponsors whose mentoring has contributed to the research produced by our presenters:

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The Helen Hardin Honors College thanks the following faculty members for providing feedback to the student presenters:

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Rui Qi
Erin Yoser

Design and Publication

Scott Dutt, Honors College
UofM Marketing and Communications

Presentations (12:00 - 2:00)

Ballroom A

12:00 Sabriyya Shaw

Text Conflict Study

Mentor: Jason Braasch, Psychology

12:30 Kaeli Johnson

Self-Regulation and Protective Behavioral Strategies as Mechanisms in the Relation between Depression and Problematic Alcohol Use: A Serial Mediation Model

Mentor: James Murphy, Psychology

1:00 Paul Anderson

Using Clusters to Predict Belief Change

Mentor: Jason Braasch, Psychology

1:30 Kristin Mae Talens

Social Influence and Conforming Behaviors: Inducing Peer Pressure with Preferential Judgements Measured by Computer Mouse Tracking Technology

Mentor: Gina Caucci, Psychology

2:00 Jacob Burkley

Employment and Income Following Intimate Partner Violence: Does Mental Health Moderate Negative Employment Outcomes?

Mentor: J. Gayle Beck, Psychology

Beale Room

Stasia Mallin

Elution of Curcumin from Electrospun Chitosan Membranes for Local Delivery Systems

Mentor: J. Amber Jennings, Biomedical Engineering

Todd Soyka

Horizontal Shaft Hydro-Kinetic Electric Generator

Mentor: John Hochstein

Elijah Gasmen

Simulation and Optimization of Aerogel Packaging Solution for Cold-Chain Biologistics

Mentor: Jeffrey Marchetta, Mechanical Engineering

Bluff Room

Heather Eudy

Halloween Loomis

Mentor: Cary Holladay, English

Tom Borg

Anonymous Online Narratives from Female Perpetrators of Sexual Violence in Their Own Words: A Phenomenological Inquiry

Mentor: Tracy Hipp, Psychology

Samantha Stemmer

Send Your Inner Lizard to Obedience School: Evaluating the Wim Hof Method as an Alternative Post-Traumatic Stress Treatment

Mentor: Margaret Landry, Social Work

Carina Hicks

Assessing Cortical Dopamine Transmission in a Genetic Rat Model of ADHD

Mentors: Deranda Lester, Psychology; Helen Sable, Psychology

Gwendalyn Johnson

Examining the Depression-Related Behavioral Effects of Oxytocin Administration

Mentor: Deranda Lester, Psychology

Presentations (12:00 - 2:00)

Poplar Room

12:00 Sara Ann Davidson
Association Between Joint Kinematics During Variations of a Single Leg Squat and Running Kinematics
Mentor: Max Paquette, Health Studies

12:30 Julian Rome
The Five Attempts at an Account of Philia in Plato's Lysis
Mentor: Tim Roche, Philosophy

1:00 Chiemi Fujio
Blues Challenges to Find A Home in Japan
Mentor: Lorainne Meiners-Lovel, Professional and Liberal Studies

1:30

2:00 Julia Schwartz
Coupling Tectonic and Surface Process Modeling
Mentor: Eunseo Choi, Center for Earthquake Research and Information

Memphis A

Lynda Flowers
Optimization of Calcium Phosphate Transfection for GPCR High-Throughput Screening of Drug Candidates
Mentors: Daniel Baker, Judith Cole, Abby Parrill, Kristie Ruddick, Chemistry

Miriam Spears
Our Compass Truth: The West's Legacy to Biomedical Ethics
Mentor: Christie Manasco, Nursing

Allison Banks
MAP3K4 Regulates Expression and Localization of Water Channels in Trophoblast Stem Cells
Mentor: Amy Abell, Biological Sciences

Jacob Seboly
Tornado Vulnerability in Tennessee
Mentor: Esra Ozdenerol, Earth Sciences

Bennett Poorman
A Modified Exponential Decay Model for Multidose Drug Elimination
Mentor: Gisèle Goldstein, Mathematical Sciences

Presentations (2:30 - 4:30)

Ballroom A

2:30 Sonia Hopkins

Associations Between Early Childhood Stress, Cognitive Functions, And Marijuana Use

Mentor: James Murphy, Psychology

3:00 Destinee Cruthird

Working Memory Deficiencies in ADHD Prone Rats

Mentor: Helen Sable, Psychology

3:30 Lindsay Ringer

Examining the Effect of Kratom on Dopamine Transmission Related to Abuse Liability

Mentor: Deranda Lester, Psychology

4:00 Aaron Byrn

Environmental Enrichment Protects Against Behaviors Related to Anxiety and Addiction in Mice

Mentor: Deranda Lester, Psychology

4:30 Katherine Zerit

Whataboutisms, Refutations, and the Misinformation Effect

Mentors: Jason Braasch, Psychology; Stephanie Huetter, Psychology

Beale Room

Serena Jones

The Effects of Social Isolation on Anxiety and Addiction-Related Behaviors in Adolescent and Adult Mice

Mentor: Deranda Lester, Psychology

Alexis Johnson

Covalent Attachment of Cis-2 Dece-noic Acid to Electrospun Chitosan Membranes for Biofilm Inhibition

Mentor: J. Amber Jennings, Biomedical Engineering

William Guyton

Modeling of Iron Deposits in the Human Liver

Mentors: Aaryani Sajja, Biomedical Engineering; Eddie Jacobs, Electrical Computer Engineering

Rayven Covington

Analysis of the Applicability of Mini-Piezometers as an Alternative to Traditional Methods of Studying the Hyporheic Zone

Mentor: Claudio Meier, Civil Engineering

Sophia Lemus

Examining the Impact of Stress During Adolescence and Adulthood on Dopamine Release Related to Addiction

Mentor: Deranda Lester, Psychology

Bluff Room

Eleanor Fisher

Additive Manufacturing as Applied to Ceramics

Mentor: Kate Roberts, Art

Joshua Potter

Inhibitory Control in Lphn3 Knockout Rats

Mentor: Helen Sable, Psychology

Tristin Hicks

Inherit the Wind Dramaturgy Packet

Mentor: Holly Lau, Theatre and Dance

Amanda Campbell

Preaching Protest: The Moral and Political Power of Memphis Religious Leaders During the 1968 Sanitation Workers' Strike

Mentors: Aram Goudsouzian, History; Colin Chapell, Professional and Liberal Studies

Hunter Franks

The Effects of Environment in Adolescence On Risky Decision-Making

Mentor: Nicholas Simon, Psychology

Presentations (2:30 - 4:30)

Poplar Room

2:30 Elias Apel

Confusion and Closure in Black and White

Mentor: Lorinda Cohoon, English

3:00 Jason Lin

The Effect of Dietary Fats on Healthspan in *Drosophila Melanogaster*

Mentor: Melissa Puppa, Health Studies

3:30 Melody Wilson

Structure and Morphology of Bio-compatible Polymer Brush Surfaces

Mentor: Tomoko Fujiwara, Chemistry

4:00

4:30 Abdul Elayan

Nanoluciferase-based G Protein-Coupled Receptor/G Protein Complementmentation Assay for GPR88 Deorphanization Efforts

Mentors: Abby Parrill-Baker, Chemistry; Kristie Ruddick, Chemistry

Memphis A

Harmeet Singh

Impact of Induced Fit During GPCR Homology Modeling

Mentors: Abby Parill-Baker, Chemistry; Daniel L. Baker, Chemistry

Heather Nelson

Development of Cell-Based Assays for High-Throughput Screening and Signaling Pathway Elucidation of GPCRs

Mentors: Abby Parill-Baker, Chemistry; Kristie Ruddick, Chemistry

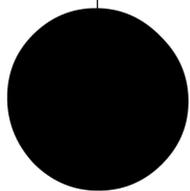
Jacob Parks

Investigation of Adhesion Behavior of Mars Regolith on Aerogel Substrates

Mentor: Firouzeh Sabri, Physics and Material Science

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Abstracts

Engineering

Analysis of the Applicability of Mini-Piezometers as an Alternative to Traditional Methods of Studying the Hyporheic Zone

Rayven Covington

Mentor: Claudio Meier, Civil Engineering

The main goal of this research was to analyze PVC mini-piezometers as an alternative method to enable the detailed study of hyporheic exchange flows under river beds. K_{sat} is the saturated hydraulic conductivity; it is how well the water permeates and travels through the porous material of the river bed. To measure K_{sat} , measurements must be taken at many varying locations and depths of the river bed; which is often time consuming. Of course, there are machines that could measure K_{sat} as well, but they are not only large and exuberant in price, but also pose a threat to the natural layering of sediment. When it comes to using mini-piezometers as the alternative, they are already largely favored, but still have problems that lend incongruence to data collected. Firstly, we analyze field data with equations meant for large-scale piezometers that are often used to test conductivity of water outside of rivers. Additionally, the equations used yield different values of K_{sat} because they use variables that aren't scaled respectively, or do not consider conditions that make mini-piezometers different.

This study was designed to observe and analyze how changing variables (area and number of holes, screen length, height of screen, and depth of sediment), when constructing the mini-piezometers, affected the flow of water through the porous material. In all, 36 holed and 2 slotted pipe variations and 12 different height and depths were tested. All tests were conducted in a 13-gallon (49.2 liter) apparatus with a "course homogeneous" fine grained sand. The test itself was run in close accordance to the procedure for "Falling Head Permeability Test" where the pipe and sand were placed in the apparatus with a water table that flowed freely over the lip of the apparatus. A hose and reservoir were then attached to the pipe and water from the reservoir was injected into the pipe and time was collected at interval heights of 5 cm. From the tests, the volume of water was computed and compared for each pipe in the variable group.

Results from the tests aligned with the physical characteristics of water that is exposed to larger area, diameter and quantity of holes. From the research we observed that the water flowed at higher pressure when the area of holes, number of holes, and screen length were increased linearly in almost all cases. We found that the slotted screens increased logarithmically leading us to believe that the discharge (volume v. time) would eventually plateau. We also found that changing the depth of sediment and height of the screen had an inverse effect on the discharge, meaning that with the pipe at lower depths the discharge was slower in comparison.

In conclusion we found that these variables are necessary to take into consideration when applying the larger scale equation to mini-piezometers. Also, we found that the data does still validate their use. We still want to expand this research by using a larger apparatus to negate wall effects.

Simulation and Optimization of Aerogel Packaging Solution for Cold-Chain Biologics

Elijah Gasmen

Mentor: Jeffrey Marchetta, Mechanical Engineering

Long distance transportation of biological and pharmaceutical materials is currently limited because most containers have a limited time that the temperatures inside the containers can be kept steady and at the required low temperature. Aerogels are currently known as the best insulating material and have demonstrated superior thermal insulating capability compared to materials commonly used in shipping and storage industry such as extruded polystyrene and polyurethane foam. Its lightweight and biologically-friendly nature makes this material an excellent choice for biologic packaging solutions. Previous experiment data and modeling has demonstrated the feasibility of using aerogel as a component material in a wide variety of low temperature (77K – 273K) applications. Modeling was used to further optimize the aerogel packaging in an effort to maximize the thermal insulation capability with respect to conventional packaging dimensions. The project will perform simulations of a full-scale aerogel-based packaging solution for transporting vials under realistic thermal loads that the package would experience during transport from packaging to delivery. The results obtained using a full-scale fluid thermal simulation for the aerogel packaging solution will be compared to results obtained using other conventional packaging materials to demonstrate the feasibility of using an aerogel solution for cold-chain biological shipping.

Modeling of Iron Deposits in the Human Liver

William Guyton

Mentors: Aaryani Sajja, Biomedical Engineering; Eddie Jacobs, Electrical Computer Engineering

The most common method of measuring the iron composition of the human liver is a biopsy, which can be painful, invasive, and expensive. Measuring iron concentrations in the liver is important to the diagnosis of iron overload, which can be a lethal symptom to patients with other diseases, such as beta-thalassemia and blood transfusion-dependent sickle cell anemia. Due to this, MRI has been considered as an alternative to the biopsy. MRI analysis could prove to be more efficient in the measurement of iron concentrations, as well as improve patient comfort and total cost.

Four different models of sections of the liver were made in MATLAB, each with an increase in the accuracy of iron distribution. The first model is a random distribution of iron spheres and the second is a random distribution for each liver cell. The third model is similar to the second except for a distance requirement put into place for each iron sphere, and the last model used the iron sphere to model high iron concentration sinusoids found in the liver. These models were described by using the shape and scale parameters of a gamma distribution. Then, they were then compared at different hepatic iron concentrations to see how the models compared at different levels of iron. The gamma distribution used to generate the iron sphere radii

was compared to the HIC value used by using a histogram, showing that the shape and scale factor both grow linearly according to the HIC value. The position of these iron spheres, as well as their size and angle relative to the x-axis around the z-axis, were used to derive a histogram of dipoles.

For the four models generated, the conditions specified more clustering and caused a larger difference in density throughout the liver model. In a random distribution, the density is roughly uniform in the model. Once cellular anisotropy is included in the second model, density is uniform per hepatocyte. The third model includes a nearest neighbor parameter for placement, which in reference to this size of the iron model, creates more clustering. The inclusion of sinusoids creates clustering in cylinders placed between hepatocytes.

An *in vivo* model mimicking hepatic iron overload was developed in this study. This knowledge will be used to generate an MRI signal and also develop similar models for fat deposition and modeling in future research. Fat will have to be modeled with the iron concentrations in the future due to MRI interference fat can cause when quantifying iron.

Covalent Attachment of Cis-2 Decenoic Acid to Electrospun Chitosan Membranes for Biofilm Inhibition

Alexis Johnson

Mentor: J. Amber Jennings, Biomedical Engineering

About 80% of infections are caused by bacterial biofilm, which is bacteria attached to a surface. Cis-2-decenoic acid (C2DA) is a natural fatty acid bacterial signal to disperse from biofilms. This is potentially clinically useful in preventing infection, but there is a need for a local delivery system for it. An electrospun chitosan membrane has functional groups on the linear polysaccharide, which allows bonding to fatty acids. Chitosan membranes with attached cis-2-decenoic acid chloride may offer biocompatible extension of delivery as well as surface protection. Our research objective for this study was to construct chitosan nanofiber membranes with covalently bonded C2DA and to determine whether C2DA is eluted and inhibits biofilm. Cis-2-decenoic chloride was produced using 0.15 mol thionyl chloride and 0.1 mol cis-2-decenoic acid with a chloride reflux reaction. Evidence of covalent bonding was confirmed with Fourier Transform infrared spectroscopy (FTIR). An elution study was performed in PBS for 7 days, after which concentrations were measured with high-performance liquid chromatography (HPLC); after 7 days, membranes will be placed in bacterial lipase to determine whether bacterial enzymes could trigger release of C2DA. One of the most important findings relates to the FTIR spectra confirming that the intended reaction occurred, resulting in ester bonds. Determining how much C2DA the membranes elute is still in progress. Ability of C2DA directly attaching to chitosan could provide extended elution and protection of surfaces from biofilm. Further investigation is necessary to explore characterizing the elution and anti-biofilm activity using microbiological assays. An example of an application where C2DA modified membranes could be used is in wound healing applications, bone defects, and dental guided bone regeneration membranes to defend healing tissue against infection.

Elution of Curcumin from Electrospun Chitosan Membranes for Local Delivery Systems

Stasia Mallin

Mentor: J. Amber Jennings, Biomedical Engineering

Polyphenol curcumin, a component of turmeric, has become a major point of interest in the medical world because of its antioxidant and

anti-inflammatory effects, which can help conditions ranging from metabolic syndrome to arthritis to anxiety. A major limitation in delivery of the hydrophobic curcumin is maintaining active concentrations for extended periods. Electrospun chitosan membranes may be stabilized with hydrophobic acylation, which has been shown to sustain delivery of other hydrophobic molecules such as simvastatin. This led to our research question: Can electrospun chitosan membranes loaded with curcumin elute curcumin at therapeutically effective levels? If so, for how long? First, we loaded hexanoic acylated electrospun chitosan membranes with curcumin dissolved in ethanol at varying concentrations, and then completed an elution study of the membranes in phosphate-buffered saline (PBS) over the course of 7 days. We analyzed the eluates via spectrophotometry and High Performance Liquid Chromatography (HPLC). Initial results indicate that curcumin is released in small amounts and that it breaks down into curcuminoids as it elutes. By visual observation, curcumin is retained within the membranes over extended periods. We plan to repeat the study using different loading solutions to determine the best method. Further research may explore different biomaterial compositions such as nanoparticles and hydrogels for use in different applications. Future applications of curcumin-loaded chitosan biomaterials could be a viable option for local treatment of inflammatory conditions within the body, including delayed wound healing, arthritis, and cancer.

Horizontal Shaft Hydro-Kinetic Electric Generator

Todd Soyka

Mentor: John Hochstein, Mechanical Engineering

Renewable and sustainable energy has been a focus of research for many years. Through research and development, many innovative ideas have created a variety of options that provide electricity to the marketplace, either by providing power directly to a structure or to the Power Grid. Renewable energy research has been categorized into five main groups; Hydro, Solar, Wind, Geo-Thermal and Biofuel. Biofuel has great potential for transportation applications, but it still releases CO₂ emissions. Geo-Thermal is a promising field and the future of heat pumps seems limitless. This technology is exciting, but for the most part, energy production in this field requires Geo-Thermal activity that lies outside the scope of my research. About ten years ago, sustainable power production using wind started to grow at an accelerating rate, but in the last half-decade, the rate of growth has declined due to the large footprint of a wind farm, the intermittent power production that comes with calm weather and the repair cost for mechanical failures. In that time, Solar power production has seen minor improvements, but it too requires a large footprint, a sophisticated tracking system to follow the sun across the sky and it typically produces power for less than 12 hours a day. Hydroelectric power is still our largest source of sustainable energy. Although it is a source of continuous power, our current hydroelectric dam designs require a very large water reservoir and have some undesirable environmental consequences.

Research, including my own, shows that hydroelectric power can be produced by harvesting the kinetic energy in a naturally occurring flow to produce electricity, unlike a dam reservoir. My research identified 13 major organizations currently in the development of hydro kinetic energy using low-to-no-head designs and our findings show the potential to provide continuous power with no fuel cost and with a relatively small environmental impact. Assessing the 13 organizations, 11 are the same or similar design whereas 3 (including mine) are unique.

After presenting a Hydro-Kinetic Generator design and proposing a partnership with the University of Memphis, I continued my research and development at the university. I established design goals, developed an experiment to test the design goals and yield empirical

data, built a laboratory testing apparatus that can reproduce various moving water conditions (Rivers and Gulf Stream), built a scale model generator, and conducted experiments. The design, construction, and operation of the experiment apparatus are each described. Preliminary experiment results are presented. Proof of concept has been established, and the groundwork has been laid to learn more about the performance characteristics of this novel technology. This design eliminates some of the roadblocks currently faced by the 13 organizations and early testing indicates greater success upon deployment.

Liberal And Fine Arts

Confusion and Closure in Black and White

Elias Apel

Mentor: Lorinda Cohoon, English

David Macaulay's Caldecott Award winning picture book *Black and White* (1990) begins like a brain training game: The first page bears the title printed in red, creating a mismatch between the words' meaning and the color choice. Below the title is an illustration of symmetrical black and white structure broken into pieces. Next is a warning to the reader, also printed in red, that this story may contain several stories, maybe only one, and to carefully examine the relationship between picture and text. Critics have described Macaulay's work as an example of a postmodern picture book and praised its approach to teaching children to read critically and question what they have been presented with in their search for meaning. Reader responses, however, have also expressed confusion and frustration with *Black and White*. For instance, Anstey (2002) quotes a student saying "I liked *Who Sank the Boat?* (Allen, 1996) better; it was fun, easy, and told you the story."

This paper seeks to examine the reader experience of *Black and White* with the help of Molly Bang's design principles as presented in *Picture This* (1991). After an introduction to the book's layout and storylines I will closely examine a selection of illustrations and their impact toward making sense of the book. My goal is to discover how the means by which Macaulay creates confusion and which aspects of the book may support readers in reaching an understanding of the work.

Preaching Protest: The Moral and Political Power of Memphis Religious Leaders During the 1968 Sanitation Workers' Strike

Amanda Campbell

Mentors: Aram Goudsouzian, History; Colin Chapell, Professional and Liberal Studies

In this thesis, I will engage with primary source collections, including the Memphis Search for Meaning oral history collection housed at the Ned McWherter Library, archived student newspapers from Memphis State University (now The University of Memphis) and Southwestern College (now Rhodes College). With not only a focus on the months of the strike itself, but this project will also include analysis of the long history of religious leaders engaging in Southern politics. In my research, I am seeking to answer questions such as:

- How did faith leaders (both black and white) justify their decisions to intervene or not intervene in the Sanitation Workers' Strike in 1968?
- Does their intervention represent a departure from or continuation of previous religious involvement in politics-- specifically as it relates to issues of race?

- In what ways did the Sanitation Workers' Strike of 1968 lay the groundwork for future interfaith organizing in Memphis?
- How do different religious organizations that are still active in Memphis remember the strike and their role in it? Are these representations useful?

Though I will base my conclusions on primarily primary source archival research, I will also consult a wide range of secondary and tertiary sources. My thesis will include a historiographic section which will establish the intervention into the existing literature my work attempts to make. I will then provide an analysis of several specific groups or individuals' roles in the strike. I will use these stories to point to the larger story of the intent and impact of religious leaders' moral authority in the South in the 20th century.

Halloween Loomis

Heather Eudy

Mentor: Cary Holladay, English

John Carpenter's Halloween movie franchise began as a singular, low budget, horror film in 1981. Carpenter, as writer, producer, composer and director did not foresee the movie turning out to be much more than what it was - a scary tale about babysitters who get murdered by a white-masked villain. Now, forty years later, Carpenter's multi-million-dollar Halloween series, which tells the life of the fictitious serial killer Michael Myers and his psychiatrist Dr. Samuel Loomis, has developed into an eleven-movie saga, counting two renditions that Rob Zombie, famous heavy metal artist, designed. Six-year-old Michael Myers murders his sister on Halloween night in 1978, in the fictitious town of Haddonfield, Illinois. He is then sent to Smith's Grove Sanitarium, where he is looked after by Dr. Samuel Loomis. Fifteen years later, he escapes in search to kill his other sister. The iconic masterpiece that John Carpenter created and continues to create, with two new movies on the horizon, has stood the test of time thematically. However, the newest movie released in 2018, *Halloween*, is written in such a way that discards all the movies apart from the first film. The newly released movie, and the two that soon follow, bring a different story line, diminishing the initial one. *Halloween 2018*, and its counterparts, therefore, erase several characters from the original script that have become, for the audience, a stable part of the story's foundation. My novel, *Halloween Loomis*, clearly represents the much-needed legacy of Samuel Loomis, through my originally designed character, Dr. Wilhelmina Grace Loomis, who is his daughter. I am a creative writing concentrator, and the Halloween movie series has inspired me to write a novel based on it. A portion of my novel is an honors project supervised by Professor Cary Holladay, coordinator of the Creative Writing Program. *Halloween Loomis* is titled after the protagonist of the story, Dr. Wilhelmina Grace Loomis. My story fills in gaps the original thematic set left empty, and the latest 2018 edition leaves blank. The legendary horror character, Dr. Samuel Loomis, written by John Carpenter, played by the late British actor Donald Pleasance, acts as psychiatrist to the heinous insane serial killer Michael Myers within the sequence. Loomis plays a key character and will be plunged away with Carpenter's newest story line. *Halloween Loomis*, the novel, reprises his character through the life of his daughter, Wilhelmina Grace Loomis. Grace serves as my very first fiction written original character, as well as my inspiration for the *Halloween Loomis* work in progress. I created a story around her that kept vital parts of Carpenter's original work, by only adding creative fiction and more originated characters to enhance Grace's existence within my fulfilling plot. My idea of this woman character evolved into a protagonist of my first attempted novel. With her, came an original multilayered story.

Additive Manufacturing as Applied to Ceramics

Eleanor Fisher

Mentor: Kate Roberts, Art

The purpose of this project was to explore the applications and limitations of 3D Printing ceramics using the 3D Potterbot Micro 8. I utilized Rhino CAD Modeling software and Meshmixer to create 3D models to print, and the slicing programs Ultimaker Cura and Simplify3D to print the models.

Over the course of this project, two slicing programs were utilized; Cura and Simplify3D. We began the project using Cura, and found it to be largely incompatible with the 3D Potter, as the same file would produce inconsistent results when the print collapsed, tore, slumped, or dragged. Simplify3D was much more effective in producing prints that resembled the 3D model.

While the prints produced with Cura were largely departures from the 3D models that they are based on, they still hold value from an artistic standpoint. While the machine failed in its task to produce a perfect copy of the 3D model, it succeeded in creating an irreplicable art object. These incorrectly printed models offer an exploration of the limitations and malfunctions of a machine and the person who operates it, and allows us to explore the variations that can occur within the idea of an "error." Prints that were produced using Simplify3D were more true to the original model and captured the small details better. The objects printed with Simplify3D were also less likely to slump or deform during the printing process because they had thicker walls due to the layers of clay being compressed as they were printed.

Simplify3D is much more suitable than Cura if the aim is to produce ceramic objects that are replicas of the original 3D model with high levels of detail and structural stability. The addition of a bottom, in order to produce a functional vessel is also consistently successful using Simplify3D software. Furthermore, due to the consistency and functionality of prints produced with Simplify3D, I was able to experiment with printer settings in order to achieve varied surface effects. The extrusion flow rate and layer height were adjusted in order to change the level of detail attainable and the surface texture, as well as the wall thickness and structural stability of the pieces.

Over the course of this project I have developed an understanding and appreciation of how 3D printing can be applied to ceramics and gained the tools and skills to produce artwork using this method. I have developed a repertoire of techniques that I can use to fabricate both figurative and abstract work in this medium. In the future I hope to continue this exploration of ceramic 3D printing by working on much larger figurative forms as well as functional vessels. With the assembling techniques I have developed I would like to begin printing and assembling large full body figurative forms to compliment my figurative work in other mediums such as painting.

Blues Challenges to Find a Home in Japan

Chiemi Fujio

Mentor: Lorraine Meiners-Lovel, College of Professional and Liberal Studies

The research introduces blues music as an American traditional culture in music by comparing with non-traditional music as well as characteristics and history of blues music. Sometimes traditional cultures expand to other areas and overseas countries once people outside get interested and elements are acceptable there. Blues music as one of American traditional cultures in music originated in Delta area made successful expansion over nationwide and overseas countries. While domestic expansion is nationwide, overseas expansion is limited.

There are countries that have high popularity of blues music and low popularity and poor recognition of blues music. The research explains how overseas expansion was made and successfully increased the recognition and popularity and the reason which made expansion unsuccessful in some countries, such as Japan. There is detailed information about Japanese that relates to blues music and its effects on gaining recognition and popularity of blues music. Finally, the research seeks the way to increase popularity of blues music in Japan as one of the areas that have difficulties to accept elements of blues music by studying items in the previous section, also identifying important elements of blues music that are not recognized in Japan. Detail explanations about blues music are throughout the paragraphs including its background, styles, and characteristics.

Inherit the Wind Dramaturgy Packet

Tristin Hicks

Mentor: Holly Lau, Theatre and Dance

In 1925 a battle raged in the courts at Dayton, Tennessee. Thirty years later, an adaptation of that story was created and fought its way onto the theatrical stage and would become the most produced play in the country at the time. This informational packet is designed to tell both stories and to prepare The U of M's Cast of Inherit The Wind with as much relevant information as possible by telling the story of the Scopes "Monkey" Trial, the story of the show's beginnings and the writing duo that created it, educating the cast on what a trial play is, describing the differences between the characters in the play and the real people that inspired them, and what happened to the people and Dayton once the verdict was read. Each name and every event found in this document denotes two of this country's greatest struggles for the right to speak, but more importantly the right to think. This document talks about the most controversial education law in the state's history, and two playwrights who adapted that all too real tale in order to battle the injustices of the McCarthy era. For the pure purpose of the information in preparation for performance, the cast and crew of Inherit The Wind will read this document as they prepare to bring Hillsboro to The University of Memphis' Mainstage.

The Five Attempts at an Account of Philia in Plato's Lysis

Julian Rome

Mentor: Tim Roche, Philosophy

Plato's Lysis contains several potential accounts of philia, commonly translated as friendship, put forth and refuted by Socrates and his interlocutors, Lysis and Menexenus. This plurality of accounts poses a problem for interpreters, especially given that the dialogue is apparently aporetic; indeed, its concluding lines include a remark by Socrates that they have not yet discovered what a friend is. Given these uncertainties, contemporary commentators have argued a range of interpretations concerning which account of philia, if any, Plato is endorsing in the dialogue. Furthermore, many interpretations of the dialogue position Plato's Lysis in relation to Plato's Symposium or Aristotle's Nicomachean Ethics, arguing that it brings up problems that are solved in these later works and fails to solve these problems on its own. Yet, we will find that Plato's Lysis does itself adequately respond to the problems that it raises, presenting a clear endorsement of the final account of philia put forth in the dialogue, the account of philia as kinship or belonging.

In my reading of Plato's *Lysis*, I examine the five individual attempts, each of which is clearly marked by a shift in both the primary interlocutor and the driving question that Socrates poses to this interlocutor. By looking at the *Lysis* in this way, it becomes clear that Plato is endorsing the fifth and final account of *philia*, which argues that the friend is that which is *oikeon*, kin or belonging. I come to this conclusion through the following: (1) comparing the argumentation in each account, (2) examining the ways in which the literary context interacts with the argumentation, (3) examining the ways in which each prior attempt provides a basis for the argument in the fifth attempt, and (4) examining the philosophical purpose of the turn from the fifth account to the aporetic ending. With respect to (1), we find that the fifth account is, indeed, a coherent position within the context of the dialogue. With respect to (2), I argue that there are interpersonal demonstrations of *philia* presented throughout the dialogue that endorse the fifth account. In (3), I find that each attempt serves a distinct purpose, in so far as it anticipates or puts forth key premises for the final attempt. Finally, through (4), I argue that the aporetic ending does not undermine the final account of *philia*, as it serves to make a different, related point regarding philosophical education. Given the remarkable ways in which each of these three criteria demonstrates support for the fifth account of *philia*, then, I argue that this is the position that Plato is endorsing in the *Lysis*.

Life And Health Sciences

MAP3K4 Regulates Expression and Localization of Water Channels in Trophoblast Stem Cells

Allison Banks

Mentor: Amy Abell, Biological Sciences

During early embryonic development, blastocyst cavitation is established by the expression of specific proteins called aquaporins (AQPs) at the cell membrane of trophoblast stem (TS) cells in the trophectoderm layer. AQPs allow water transport into the blastocyst under high osmotic gradient during cavity formation. Our goal is to define the mechanisms that regulate the expression and localization of aquaporins during the cavitation process. We have discovered that inactivation of a kinase called MAP3K4 in trophoblast stem (TSK14) cells results in the failure to respond to osmotic stress. Wild-type TS (TSWT) cells respond immediately to osmotic stress by shrinking. In contrast, TSK14 cells do not change cell shape after osmotic stimuli. We predict that the failure to respond is due to the loss of expression or mislocalization of water channels. To test our hypothesis, we examined the responses of cells to osmotic stress using phase microscopy and live cell imaging. Also, we measured the expression and localization of AQPs using qPCR and immunofluorescence, respectively. Our preliminary data show that only AQP3 and AQP9 are expressed in the trophoblast stem cells. AQP3 expression is decreased in TSK14 cells relative to TSWT cells. AQP9 is increased in TSK14 cells relative to TSWT cells. Immunofluorescence experiments show that AQP3 is localized to the cell surface in TSWT cells, while it is mislocalized in TSK14 cells. Together these data show that MAP3K4 activity is important for the expression and proper localization of AQPs in TS cells, which is important for responses to changes in osmotic gradient.

Association Between Joint Kinematics During Variations of a Single Leg Squat and Running Kinematics

Sara Ann Davidson

Mentor: Max Paquette, School of Health Studies

In clinic, physical therapists choose tests such as the single-leg squat (SLS) to assess injury risks but injury-related joint motions during slow repetitions (i.e., 3s to completion) of the SLS are not associated with knee motions during running in injured runners [1]. Assessing kinematics during SLS variations at a faster speed and during a single leg hop (SLH) may be more applicable and predictive of running kinematics. The purpose of this study was to assess the correlation between joint kinematics during variations of the SLS with joint kinematics during treadmill running. We hypothesized that joint kinematics during a SLH would be strongly correlated but that joint kinematics during slow and faster SLS would be weakly to moderately correlated to running kinematics.

20 young adult participants warmed up for 5 minutes on a treadmill. Participants then performed 5 repetitions of 3 types of single leg squats: slow SLS (3s/rep), fast single leg squat (1.5s/rep), and a SLH (0.9s/rep). A metronome was used to control the pace of each squat variation. Participants also ran for 5 minutes at their preferred pace. A 3D motion capture system was used to track movements of their pelvis and right lower limb. From the motion capture data, joint angles were calculated. The mean of all squat variations and running trials were used for statistical analyses. Pearson's Correlation Coefficients were computed to assess the association between joint kinematics during running and each SLS variation.

Peak knee flexion, peak anterior pelvic tilt, peak hip adduction, peak hip flexion, peak hip internal rotation, peak knee abduction, and peak contralateral pelvic drop (CPLD) were moderately to strongly correlated ($r \geq 0.53$, $p \leq 0.05$) between running and SLH. Peak hip flexion was moderately correlated between running and the slow ($r = 0.54$; $p = 0.05$) and fast SLH ($r = 0.53$, $p = 0.05$). Peak hip internal rotation was strongly correlated between running and the slow and fast SLS ($r \geq 0.8$, $p \leq 0.01$). Finally, peak knee abduction was strongly correlated between running and the slow and fast SLS ($r \geq 0.6$, $p = 0.01$). To summarize, these findings suggest that peak magnitudes of joint kinematics are more moderately to strongly correlated between running and a single leg hop task, but poorly to moderately correlated between running and slow or fast single leg squats except for peak hip internal rotation and peak knee abduction.

In general, we conclude that physical therapists can use a single leg hop task, instead of single leg squats, as a clinical test to assess specific joint kinematic variables during running if a treadmill or running assessment space is unavailable.

Optimization of Calcium Phosphate Transfection for GPCR High-Throughput Screening of Drug Candidates

Lynda Flowers

Mentors: Daniel L. Baker, Chemistry; Judith A. Cole, Biological Sciences; Abby Parrill-Baker, Chemistry; Kristie R. Ruddick, Chemistry

About 35% of current drugs act on G protein-coupled receptors (GPCRs). GPCRs comprise a large family of over 800 integral transmembrane proteins involved in signal transduction and serve as the primary cellular sensors for chemical stimuli. The shared structural characteristics of these proteins are seven transmembrane domains (TM) connected by extracellular and intracellular loops. In GPCR signaling, receptors and heterotrimeric G proteins (made up of the G_α and $G_{\beta\gamma}$ subunits) work together to transmit signals via downstream effectors and distinct pathways via interactions of second messengers such as cyclic AMP (cAMP), calcium ions (Ca^{2+}), and ERK (MAP kinase). Greater than 20% of current clinical trials target novel GPCRs for which there are no approved drugs (orphan GPCRs). As such, pre-clinical studies in the field of GPCR signaling are the focus of countless research studies. The ability to efficiently test potential new drugs using cell-based assays in a high-throughput manner is essential to advance research in this field.

In preclinical or "phase 0" studies, mammalian cell-based test systems are commonly engineered in the biochemistry laboratory for drug screening experiments. A fundamental technique in molecular biology is known as transfection. This method introduces foreign DNA into commonly used "immortal" cell lines such as HELA, HEK-293T (human embryonic kidney), and CHO-K1 (Chinese hamster ovarian). In this work, we describe our efforts to create an efficient, repeatable, and cost-effective transfection method by which HEK-293T cells expressing GPCRs of interest are created for high throughput cell-based assays.

Foreign DNA is introduced into eukaryotic cells using physical or chemical methods. Many research labs employ costly transfection reagents such as Lipofectamine and Fugene HD. These commercially available products are easy to use and effective, yet in a high-throughput setting can be too expensive for many academic research labs. Calcium phosphate transfection is an affordable, efficient, non-toxic method for transfection of plasmid DNA. We present our efforts in optimizing a reproducible transfection method based on calcium phosphate precipitation. We have reproducibly prepared GPCR and reportertransfected HEK-293T cells for signaling pathway elucidation.

The Effect of Dietary Fats on Healthspan in *Drosophila Melanogaster*

Jason Lin

Mentor: Melissa Puppa, School of Health Studies

Obesity affects about 93.3 million US adults annually. Diet is a large contributing factor to this growing epidemic with many individuals consuming high-sugar and high-fat diets. We know that dietary fats can affect body composition and may influence chronic diseases, but less is known about the specific contributions of fatty acid on healthspan. The purpose of this study is to identify the effect of dietary fats on healthspan in male *Drosophila melanogaster*.

W1118 male *Drosophila melanogaster* were assigned into cohorts of one hundred in four dietary fat groups with three different amounts of fats (at 5-10-15% flax, olive, coconut, and vegetable). With one cohort as a control group on zero-fat diet. Life span was done daily by counting the number of dead flies and climbing once a week to check muscle function as an indicator of health.

All W1118 male *Drosophila melanogaster* dietary fats groups died within the first 24 hours, excluding the 5% coconut group with almost half of its cohort surviving to day two. Control group survived longer than any of the dietary fats groups. Those that survived passed 24 hours showed decreased climbing compared to the control group.

The result indicates 5% coconut oil influences life span male *Drosophila melanogaster*. However, it did not lead to an increase in healthspan.

Development of Cell-Based Assays for High-Throughput Screening and Signaling Pathway Elucidation of GPCRs

Heather Nelson

Mentors: Abby Parrill-Baker, Chemistry; Kristie Ruddick, Chemistry

The activation of cellular signaling pathways is crucial to understanding how and why cells respond to certain stimuli. G-protein coupled receptors (GPCRs) are a large class of cell surface receptors activated by extracellular molecules like hormones and neurotransmitters and generate intracellular signaling events. The GPCRs are activated when an appropriate ligand binds to the receptor, and in their activated forms, these receptors are used to stimulate target G proteins that couple the production of second messengers, causing the transduction of a cellular signal. However, there are numerous GPCRs, referred to as orphan GPCRs, whose endogenous ligands are unknown, necessitating research concerned with discovering and identifying appropriate ligands so that the function of the GPCR may be determined. In this study, extracellular signal-regulated kinase (ERK) activity was measured in wild-type (WT) human embryonic kidney (HEK) 293-T cells in order to determine the ligand-mediated signals produced in these cells and to resolve the type of receptors these ligands activate so these experiments may serve as a comparison for future studies using the same cell line transfected with the orphan GPCR GPR88. The effects on ERK activity of two potential GPR88 ligands, ITA and 2-PCCA, in the presence of α and β antagonists were examined using a phospho-specific antibody cell-based ELISA (PACE) assay that employs an activation-specific ERK antibody. The cells were treated with increasing concentrations of ITA or 2-PCCA \pm 10 μ M propranolol or phentolamine and incubated for up to 30 minutes. Assays were then developed and read at 450 nm. Time and dose dependent responses to both ITA and 2-PCCA were apparent in the WT HEK cells, displaying that these agonists are not GPR88 specific agonists. This response remained apparent in cells treated with ITA + phentolamine, but the dose-dependent response was lost in cells treated with ITA + propranolol. The dose-dependent response was also lost in the cells treated with 2-PCCA + phentolamine and those treated with 2-PCCA + propranolol. The loss of the dose-dependent response to ITA when the β antagonist was present suggests that the GPCRs present in the HEK cells respond to ITA and that this ligand works with β receptors. The loss of the response to 2-PCCA with both antagonists suggest that this ligand activates both α and β receptors. Ultimately these results give insight as to how the receptors present in the WT cells activate with the potential GPR88 ligands present and what type of receptors these ligands stimulate. These preliminary findings are very crucial in order to gain understanding from future experiments involved with HEK 293-T cells transfected with GPR88 so that the ligand dose-dependent response from those experiments may be recognized and differentiated from the response to the receptors already present in the cells and potentially lead to the deorphanization of GPR88.

Our Compass Truth: The West's Legacy to Biomedical Ethics

Miriam Spears

Mentor: Christie Manasco, Nursing

This thesis proposes that until the nineteenth and twentieth centuries, the West held one common principle amongst many, that human life is inherently precious because it was made by an intelligent Creator for an ultimate purpose, and that it is the rejection of this principle that has resulted in the modern bioethical dilemmas. Also, and in relation to this principle, the West has recently ceased to believe in absolute truth and thus absolute right and wrong and it is this foundational shift which has contributed to the unravelling of ethical integrity. The great thinkers of Western philosophy and ethics believed in objective truth but, over time, disagreed on its source, man's reason or God's revelation. Due to the changes that took place in Western thought over the last two hundred years, God's revelation has ceased to be the authority in the West as mankind has begun to view itself as godlike, manifesting its power through technology and applying it to other humans through the practice of medicine. The consequences of this are also the subject here.

Advances in medical technology have created ethical questions that determine life and death; increasing divides and dilemmas bespeak an inability to answer these questions with authority. Lacking any sure standard, we in the West are no longer sure what is ethical and so we are incapable of being consistent. The question must be asked: what is the future of such a world? This question produces another. What does our past tell us? If it is the those who do not know history who are doomed to repeat it, let us know it. This thesis is a student's attempt to understand the major strokes of human history as it relates to ethical philosophy and biomedical ethics in the Western world. Major works of Western thought will be contrasted with one another to represent the shift the Western world has undergone when it comes to absolute truth, how to determine right from wrong, and the purpose and value of human life.

Math And Computer Sciences

A Modified Exponential Decay Model for Multidose Drug Elimination

Bennett Poorman

Mentor: Gisèle Goldstein, Mathematical Sciences

In many physical problems, the mathematical model of exponential decay is used to describe the behavior of the underlying process. In many of these applications, the rather basic model of exponential decay provides an amazingly accurate description of the problem. In others, more sophisticated adjustments are required to better fit the data.

In its simplest form, the basic idea of the exponential decay model is that the rate of change of the quantity of an object is proportional to the amount of the object that is present. In our study, we focus on the amount of a given drug in the body at time "t", say "Q(t)", if a dose of quantity "Q₀" is given at time "t = 0". The rate of change of the amount of the drug remaining in the body is proportional to the amount present at any time "t", that is $(dQ/dt) = -k*Q$ (1) where "k > 0" is the constant of proportionality. From elementary calculus, one can show that $k = -\ln 2/T$ where T is the known half life of the given drug. (The half life of an object is the amount of time required for half of the initial amount of the substance to eliminate. The half life for each individual drug, radioactive element, etc is a constant.)

One can also rather easily show the solution to (1) is

$$Q(t) = Q_0 * e^{(-k*t)}, (2)$$

that is (2) gives the amount of drug remaining in the body at time "t" if a single initial dose of "Q₀" is given at time "t = 0". Using (2), one can answer questions about how long the effects of the drug remain. However, in reality, most drugs are taken for days or weeks, and they are taken multiple times a day. So the simple model of (1), with solution (2), does not apply. Instead, a far more complex modeling problem is required to study this important medical issue.

The goal of our project is to develop a model that accurately describes the amount of the drug remaining in the body after it has been taken for "d" days, "q" times per day with a half life of "T". We begin our study with a single drug being given which is taken multiple times a day for a period of days or weeks. Even though we are focusing on cases where more than one dose is taken, the half life is still a critical constant in our model. The goal is to use our model to predict precisely how the drug builds up in the body over time, to describe when, if ever, toxic levels are reached, to predict how long it takes for the drug to be eliminated from the patient's system, etc. The ultimate goal is to model a system with two or more drugs that might interact.

Physical And Applied Sciences

Nanoluciferase-Based G Protein-Coupled Receptor/G Protein Complementation Assay For GPR88 Deorphanization Efforts

Abdul Elayan

Mentors: Abby Parrill, Chemistry; Kristie Ruddick, Chemistry; Judith Cole, Biological Sciences; Daniel L. Baker, Chemistry

G protein-coupled receptors (GPCR) comprise a large family of over 800 integral membrane proteins involved in signal transduction and serve as the primary cellular sensors for chemical stimuli. About 35% of current drugs act on GPCR targets and of the approximate 300 agents in current clinical trials, greater than 20% target novel GPCRs for which there are no approved drugs (orphan GPCRs). Deorphanization efforts seeking to develop therapeutic strategies by assigning function to understudied GPCRs are not trivial and have become controversial in recent years with experimental replication being problematic in ligand discovery. Notoriously complex in nature, GPCR-dependent signaling centers around receptor-ligand interactions that serve to stabilize conformational access to the intracellular signaling partners, G proteins. In GPCR signaling, receptors and heterotrimeric G proteins (made up of the G_α and G_{βγ} subunits) work together to transmit signals via downstream effectors and distinct pathways via interactions of second messengers such as cyclic AMP (cAMP), calcium ions (Ca²⁺), and ERK (MAP kinase), but experimental pathway elucidation is complicated by the tendencies for pathway crosstalk, receptor desensitization and receptor-protein promiscuity, among other issues.

Cell-based assays that monitor second messenger responses are often used as screening tools for potential agonists, however commonly used cell-lines such as HEK-293, are known to contain many endogenously expressed GPCRs that can interfere with signaling and complicate data analysis. Many classes of G_α subunits exist: G_{αs} and G_{αi/o} G-proteins modulate cyclic AMP (cAMP) through stimulation or inhibition of adenylate cyclase while G_{αq} subunits activate phospholipase C and a subsequent rapid release of intracellular Ca²⁺. Specifically, the orphan receptor, GPR88, has been linked with psychiatric diseases including schizophrenia and bipolar disorder. Lacking an endogenous agonist, the GPR88 signaling pathway is

mostly unknown, however, in vivo knockout experiments and in vitro preclinical studies with small molecule synthetic agonists indicate that GPR88 couples to Gai/o G-proteins to inhibit adenylate cyclase activity and reduce intracellular cAMP in cell-based assays. In this work, we aim to describe our challenges in the study of the GPR88 signaling pathway using second messenger cell-based assays and explain our decision to move to a real-time NanoLuc-based GPCR/G protein complementation assay.

Investigation of Adhesion Behavior of Mars Regolith on Aerogel Substrates

Jacob Parks

Mentor: Dr. Firouzeh Sabri, Physics and Material Science

One of the significant challenges to planetary exploration is the adhesion of regolith onto critical spacecraft equipment. Regolith adhesion can cause major issues including degradation of mechanical equipment, decreased solar panel efficiency, clogged air filters, and danger to astronauts. The main factors contributing to regolith adhesion are electrostatic and Van der Waals forces. Issues with regolith adhesion have been reported on both Mars and lunar missions, but Mars is particularly problematic due to suspended dust in its atmosphere, which undergoes triboelectric charging in Mars' planet-wide dust storms. One material on which regolith adhesion has not been researched extensively is aerogels. Aerogels are a porous material with an array of interesting properties such as low thermal conductivity, extremely low density, and high specific surface area. These properties have led to the growing use of aerogels in space applications, including cryogenic fluid containment, thermal insulation on the Mars Rover, and high velocity particle collection on NASA's Stardust.

The goal of this research is to understand the mechanisms behind the adhesion of JSC Mars-1 simulant regolith onto polyurea cross-linked, shape-memory, and polyimide aerogels, with PDMS and glass as controls. Several parameters including surface roughness, mass, surface charge, and surface area coverage were investigated to gain an understanding of the factors contributing to adhesion. Measurements of surface roughness and surface charge were taken with a white light interferometry profilometer and a Kelvin probe, respectively. Regolith adhesion experiments were carried out in an argon purged, low vacuum at room temperature and low humidity to try to simulate dry Martian conditions. Surface area coverage and adhesion by mass were found to be lowest on the polyurea crosslinked aerogels. The polyimide aerogels and PDMS had the most surface area coverage and adhesion by mass. These results indicate that high magnitude negative surface charge leads to more regolith accumulation. The effects of surface roughness require further investigation. Thus, future work will be focused on exploring the effects of surface roughness as well as using equipment to deposit different levels of charge to simulate the possibilities of triboelectric charging of materials in environments outside of Earth's atmosphere. Once these relationships are understood, methods to mitigate adhesion such as thin film coatings will be explored.

Coupling Tectonic and Surface Process Modeling

Julia Schwartz

Mentor: Dr. Eunseo Choi, Center for Earthquake Research and Information

Tectonics is a field in geoscience studying how large-scale geological structures such as mountain belts, sedimentary basins and large fault systems form especially in the light of plate tectonics. Surface

processes refer to all the actions runoff from precipitation does on and to the Earth's surface. They govern where and how erosion and deposition should occur on the Earth surface. Surface processes can effectively change distribution of materials on the surface and the mass and composition of the redistributed materials can have drastic influences on tectonics. Likewise, tectonic motions can alter surface topography, influencing surface processes. To understand better how the Earth works and how it has evolved to the current state, it is necessary to understand these two-way interactions between tectonic and surface processes. One approach to study these interactions is through numerical models that couple surface and tectonic processes. This research project aims to enable dynamic interaction between a landscape evolution modeling code, fastscapelib, and a tectonic modeling code, DES3D (Dynamic Earth Solver in 3D). Fastscapelib is an open-source C++ library implementing efficient algorithms for landscape evolution modeling. DES3D (Dynamic Earth Solver in 3D) is an open-source finite element code specialized in modeling deformations of lithosphere, the Earth's rocky outer layer. The coupling scheme we are going to test is to let DES3D update surface elevation over one time step by its native algorithm and then call functions in fastscapelib to modify it for the same amount of time. For truly two-way interactions, it is necessary to preserve a set of state variables for fastscapelib throughout a coupled simulation. We report progress in the beginning phase of this project, which consists of understanding the theoretical background of the two codes and how they work as well as identifying necessary programming tasks.

Tornado Vulnerability in Tennessee

Jacob Seboly

Mentor: Dr. Esra Ozdenerol, Earth Sciences

Tornadoes are the deadliest type of natural disaster in Tennessee, and detailed analysis of tornado vulnerability in Tennessee is necessary to improve preparedness. This study defines climatological risk as the likelihood of a particular location to experience tornadoes and social risk as the ability of a particular community to cope with and recover from tornado-related disasters. Climatological and social risk were combined to estimate overall tornado vulnerability across the state on a county-by-county basis. The study area was extended to include a collection of counties in surrounding states which are within the forecast areas of the four National Weather Service offices in Tennessee. Tornado count data from 1950-2017, acquired from the Storm Prediction Center, were used to assess climatological risk. Linear regression analysis indicated that out of a selection of social vulnerability indices (SVIs) from previous literature, The Center for Disease Control and Prevention's SVI best predicted tornado fatalities within the state, so it was used to estimate social risk. The study reveals that tornado vulnerability generally decreases from southwest to northeast across the state, with Lauderdale, Haywood, and Hardeman counties identified as most vulnerable. Additionally, areas of eastern Arkansas, northern Mississippi, and northern Alabama which are adjacent to Tennessee are even more vulnerable to tornadoes than any of the Tennessee counties.

Impact of Induced Fit During GPCR Homology Modeling

Harmeet Singh

Mentors: Dr. Abby Parrill-Baker, Chemistry; Dr. Daniel L. Baker, Chemistry

G Protein-Coupled Receptors (GPCR) are a class of membrane proteins that initiate cell signaling upon ligand binding and are common targets of pharmaceutical agents. A small percentage of this protein class have three-dimensional (3D) structures deposited in the protein databank that can be used as tools in the drug discovery process. A number of GPCR are considered orphans because they lack a known endogenous ligand. Likewise, most of these orphans lack any known ligands. As such additional work to examine their roles in physiology and or disease are limited. GPCR without known structures are often modeled based on other family members with known 3D structures (template structures). This research project investigates a key aspect of the modeling process, namely whether keeping the template ligand bound as a constraint for induced fit produces better models than ignoring the bound ligand. By using known GPCR structures as the modeling targets, the generated models and docked ligand positions can be compared to known structures to assess accuracy. Superposition of resulting homology models on reference crystal structures of the target allows calculation of a root mean square deviation (RMSD) which reflects the accuracy of the model. Subsequent docking of the target ligands into each model will also be performed to assess performance in predicting protein-ligand complex structures and interaction networks. The optimized workflow identified through these first steps will be applied to the construction of homology models of XX orphan GPCR to be used by future students as starting points for additional work.

Structure and Morphology of Biocompatible Polymer Brush Surface

Melody Wilson

Mentor: Dr. Tomoko Fujiwara, Chemistry

Poly(lactide) (PLA) is a biodegradable polymer with a varying material strength, making it highly functional in the biomaterial industry for implantable devices and drug-delivery systems. Similarly, polymer nano-brushes consisting of PLA chains, are attractive for surface modification of metals and ceramics. Well-structured PLA can be designed for surface immobilization through a silane-coupling reaction. Once bound, interactions between nanoparticles and the immobilized polymer brush surface can be altered with factors including temperature and solvent levels. The goal of this research is to study dynamics of polymer brushes and their reactivity with nano-sized objects, such as gold nanoparticles. The research started by synthesizing PLA with several different polymer lengths (molecular weight) via ring-opening polymerization of lactide monomer with 2-allyloxyethanol as an initiator. The second step was to terminate the PLA end group with an acetyl group. Finally, dimethylethoxysilane (M-EDS) was introduced to allyl-terminated PLA through hydrosilylation to complete the functional polymers. All products were characterized by NMR analysis. The silylated PLA were afterwards grafted onto a glass or silicon wafer surface through a silane-coupling reaction, and the surface brush structures were analyzed.

Social And Behavioral Sciences

Using Clusters to Predict Belief Change

Paul Anderson

Mentor: Dr. Jason Braasch, Psychology

This study will identify and analyze the relationships between the individual differences in responses to an already completed think aloud study. It will then use a cluster algorithm to identify patterns that may be used in a regression analysis or other form of statistical analysis to predict belief revision. While other studies have identified belief change using this data, none have attempted to predict the factors that lead to belief change. The factors that lead to prediction will be identified using the word analysis software LIWC and Coh-Metrix to transform linguistic responses to numerical data representing potential pattern categories. Then a cluster algorithm will be used to identify patterns and similarities in the number-data. A regression analysis or other form of statistical analysis will then be used to predict belief revision. The data have already been gathered. The responses are taken from a think aloud study on belief change regarding vaccines. 44 college students at the University of Memphis participated. All participants completed a prescreening, think aloud, screening immediately after the think aloud and then again two days after the initial day of the experiment. Preliminary findings using the data from that study has shown that there was a significant increase in harmful beliefs from prescreening to immediately the think aloud, and from prescreening to two days after the initial day. The key impact of this research will be that patterns characteristics in responses will be able to identify whether or not people trending into that pattern will revise or maintain their preexisting beliefs.

Anonymous Online Narratives from Female Perpetrators of Sexual Violence in Their Own Words: A Phenomenological Inquiry

Tom Borg

Mentor: Dr. Tracy Hipp, Psychology

Previous qualitative research on sexual violence (SV) has examined first-person narratives of male and female victims of SV from community, military, and college samples (Donne et al., 2018; Brownstone et al., 2018; Gutzmer et al., 2016). Investigations of first-person narratives of SV perpetration are limited, with most focused on male perpetrators (Brennan et al., 2018; Hipp et al., 2017) and prison samples (Beech et al., 2009; Muchoki, 2011). Researchers have yet to adequately explore the lived experience of female perpetrators, a growing topic of inquiry and concern among sexual violence researchers (Turchik et al., 2016). The current study seeks to understand the unique experiences of 10 female SV perpetrators who anonymously shared their stories in a post on the online community Reddit.com.

Drawn from a larger data corpus of sexual violence perpetrators' narratives posted to an anonymous online network, the current study uses interpretative phenomenological analysis (IPA) to explore the experiences of 10 female perpetrators. Following the guidance of Braun & Clarke (2013), Ortlipp (2008), and Shaw (2010), the data will be coded and analyzed using a reflexive inductive approach (rather than using a priori codes), relying on themes to emerge from the data while maintaining a comprehensive audit trail. I will use ATLAS.ti 8 qualitative data analysis software to analyze each individual narrative first, with coding, theme generation, and reflection occurring simultaneously before moving on to the next. Following individual coding, I will conduct a final IPA across cases to provide a summary of the

most salient themes across the dataset. Investigating the lived experience of female perpetrators will add to a growing body of qualitative inquiry in the SV literature and inform future empirical work on this understudied topic.

Employment and Income Following Intimate Partner Violence: Does Mental Health Moderate Negative Employment Outcomes?

Jacob Burkley

Mentor: Dr. J. Gayle Beck, Psychology

Intimate partner violence (IPV) has been found to impact many domains in the lives of victims. Prior research has indicated IPV can negatively impact a victim's mental health as well as their economic well-being. IPV raises the chances a victim will face unemployment or job instability, reducing the ability to obtain health-related services. Evidence has also been found that income is another variable that sees a decrease after exposure to IPV. Mental health is also seen to be negatively impacted, with victims being 3 times as likely to be diagnosed with a mental disorder. PTSD and depression are the most prevalent among victims and have been found to be long-lasting and chronic, impairing the daily functioning in victims of IPV after they have separated from their romantic partner. While evidence has been found for the impact IPV victimization has on both economic well-being and mental health, little research has observed the possible influence negative mental health may have on economic variables. A study found that psychological distress acted as a significant moderator on the relationship between IPV and employment, yet the parameters for psychological distress were not clearly defined. The current study hopes to fill in the gap of the current research and determine if negative mental health can influence employment rates in IPV victims. As income has been found to be impacted by IPV victimization, we will also determine the possible influence on income level in IPV victims as well. The study proposes four hypotheses: (1) we predict that PTSD severity will moderate the relationship between IPV and employment, (2) we predict depression severity will moderate the relationship between IPV and employment, (3) we predict that PTSD severity will moderate the relationship between IPV and income, and (4) we predict depression severity will moderate the relationship between IPV and income. The study sample consists of 234 female survivors of IPV who 18 years of age or older participating in a trauma research and recovery lab at the University of Memphis. Participants were included after taking a confidential screener and took part in assessments run by trained-doctoral students. Numerous measures were utilized to determine PTSD severity, depression severity, and IPV severity. Employment and income were obtained from participant's demographic information. A logistic regression was used in the current study to determine the odds of participants being unemployed or making lower income. Four unique models were run with IPV and disorder severity (PTSD and depression interchangeably) acting as predictor variables and either employment or income. An interaction was run for disorder severity and IPV to determine if mental health does act as a significant moderator. Simple slopes will be used if any interactions are significant.

Environmental Enrichment Protects Against Behaviors Related to Anxiety and Addiction in Mice

Aaron Byrn

Mentor: Dr. Deranda Lester

Stressful events that occur in childhood have a significant effect on the development of psychological disorders, such as anxiety and addiction, in adulthood. In rodents, social isolation during adolescence has been shown to model an early life stressor. Environmental enrichment for rodents consists of cage mates and physical stimuli (such as tunnels and running wheels) and has been shown to provide a protective effect on anxiety- and addiction-related behaviors. The current study aimed at distinguishing the effects of physical and social enrichment stimuli by including 3 housing conditions: EE (with physical objects such as running wheels and tunnels and cage mates), social enrichment (SE, with cage mates but no EE objects), and isolation (with no EE objects or cage mates). Mice were separated into these housing conditions at 3 weeks of age and remained for 10-12 weeks. Open field testing was conducted on each mouse for 20 min. In relation to anxiety, the less time the mouse spends in the center of the chamber indicates increased anxiety. Overall, the female mice were more anxious than the male mice. In both sexes, isolation increased anxiety relative to SE and EE conditions. In relation to drug abuse, locomotor activity and exploratory behaviors are predictors of drug-seeking. In both males and females, isolated mice displayed increased locomotor activity and rearing relative to SE and EE mice, suggesting both conditions were protective. Overall, our data supports that isolation can induce behaviors related to anxiety and addiction in mice. Our findings also indicate that social stimuli may be the protective component of EE conditions. These conclusions support the use of social interactions during programs aimed at ameliorating the symptoms of anxiety and/or addiction.

Working Memory Deficiencies in ADHD Prone Rats

Destinee Cruthird

Mentor: Dr. Helen Sable, Psychology

The symptoms of attention-deficit/hyperactivity disorder (ADHD) include impulsivity, hyperactivity and poor attention. Some research also suggests individuals with ADHD exhibit poor working memory. Recent studies have found that there may be a link between the absence of the latrophilin 3 (i.e., Lphn3) gene and a heightened risk for ADHD. The purpose of this study is to evaluate whether the absence of Lphn3 contributes to working memory deficits in an animal model of ADHD. Methods: This experiment will study wildtype rats that express Lphn3 (i.e., Lphn3+/+) and knockout rats that do not (i.e., Lphn3-/-). This experiment will utilize operant testing chambers with two response levers to measure spatial alternation behavior. The specific tasks will include cued alternation, non-cued alternation, and a final delayed spatial alternation task, the latter of which will evaluate working memory. Using a 2 (genotype) x 2 (sex) between-subjects ANOVA, the percent correct on each task will be analyzed across testing days to determine if a significant difference exists between the genotypes and whether the effect differs by sex. Results: A significant difference ($p < .05$) in working memory performance is expected with the knockout rats exhibiting a lower percent correct than the wild-type rats. Conclusion: Such results would suggest that when working memory deficits are seen in individuals with ADHD, this deficit may be the result of altered expression of Lphn3. Understanding what contributes to the symptoms of ADHD is necessary, as it could lead to further discoveries that could result in a prevention, better treatment,

or even a cure of the disorder.

The Effects of Environment in Adolescence on Risky Decision-Making

Hunter Franks

Mentor: Dr. Nicholas Simon, Psychology

Past studies have shown that environmental factors, such as low-socioeconomic status, have profound influences on brain development in adolescence, a time in which the brain has a high degree of plasticity. Adolescence is also especially important for prefrontal cortex development, which contributes to reasoning, evaluation of long and short-term rewards, impulse control, and priority setting. Individuals in a low-socioeconomic class are more prone to developing maladaptive behaviors such as risky decision-making and have an increased propensity to drug addiction. It is not fully understood the impact environmental factors, such as physical and social stimuli, during adolescence play on cortical development. The present study examined the effects of an enriched environment during adolescence on risky decision-making and sensitivity to cocaine's cognitive effects. Male Long Evans rats were split into two groups. One group of 12 were the isolated group (control) and the other being the enriched environment group. The isolated group consisted of single-housed rats in a standard cage without access to toys or social stimuli. The enriched environment group consisted of 12 rats housed together in a large cage where they had free access to toys, tubes, chew toys, running wheels, and nesting material. Rats grew in respected environments until PND = 74 when shaping for behavioral assay began. The Risky Decision-Making Task (RDT) was used to assess for risk-taking behaviors and effects of cocaine (5mg/kg, 10mg/kg, and 15mg/kg) in each group. The results showed that environment does not have a strong influence on risky decision-making. Peripheral measures such as rate to make a decision, missed trials, time spent learning the task, and overall locomotion, did not differ between the enriched environment and isolated groups. The only significant effect observed was that low dose cocaine had increased locomotive activity in socially impoverished rats, indicating that an impoverished environment increases sensitivity to the physical effects of cocaine. The findings suggest that factors other than environmental conditions are likely responsible for an increase in risk-taking behaviors often observed in people raised in isolated environments.

Assessing Cortical Dopamine Transmission in a Genetic Rat Model of ADHD

Carina Hicks

Mentor: Dr. Deranda Lester, Psychology; Dr. Helen Sable, Psychology

Attention-Deficit Hyperactivity Disorder (ADHD) is characterized by symptoms such as inattention, hyperactivity, and compulsive behavior. ADHD has a strong genetic basis, as heritability is associated with 70-80% of child ADHD cases and 30-40% of adult cases. Identifying specific genetic causes can help identify genetic risk and vulnerable populations while also shedding light on neural alterations underlying ADHD symptoms. Recent clinical studies have identified the LPHN3 gene as a candidate, and rats with this gene knocked out have shown to be more impulsive. Given that dopamine transmission in the PFC is often altered in ADHD, the proposed study aims to assess the neurochemical functioning in the PFC of LPHN3 knockout rats. Specifically, we will use in vivo fixed potential amperometry to quantify PFC dopamine release before and after administration of the dopamine

agonist nomifensine, which functions similarly to commonly prescribed ADHD medications. We hypothesize that LPHN3 KO rats will exhibit hypodopaminergic transmission, with lower percent changes following nomifensine administration, relative to wildtype control rats. The results of the proposed study will improve understanding of the role the LPHN3 gene plays in neural development, particularly related to pathologies associated with ADHD.

Associations Between Early Childhood Stress, Cognitive Functions, and Marijuana Use

Sonia Hopkins

Mentor: Dr. James Murphy, Psychology

Marijuana use is the cause of a growing social, economic, and public health concern in the United States. In 2019, there are now 33 states and The District of Columbia that have passed laws to broadly legalize the substance in some form making this a critical time to understand mechanisms of this substance. In 2013, 4.2 million Americans met clinical criteria for dependence or abuse of marijuana in the past year (NIDA, 2015). This issue has become particularly prevalent within the young adult community. In 2015, the age group with the highest prevalence rate of marijuana usage was 18-25-year olds, with 19.8% (6.9 million young adults) reporting marijuana use in the past month (NSDUH, 2015).

One established risk factor for heavy marijuana use is early childhood stress, measured by adverse childhood experiences, or ACEs (Felitti, Anda, Nordenberg, Williamson, Spitz, et al, 1998). Although ACEs are a robust predictor of marijuana use, there are also a number of risk factors. The association between ACEs and marijuana use may be because of the mediating factors of inhibition and general cognitive functioning. Using baseline data from a large longitudinal study, Project BETA, associations between early childhood stress, cognitive functioning, and marijuana use will be analyzed. The goal of this study is to examine 2 potential mediators (cognitive impairment and inhibition) in the relation between early childhood stress and marijuana use and problems in a sample of 602 21-24-year-old alcohol users from Project BETA data.

Examining the Depression-Related Behavioral Effects of Oxytocin Administration

Gwendalyn Johnson

Mentor: Dr. Deranda Lester, Psychology

Oxytocin is currently being analyzed as a potential treatment for several psychological disorders including schizophrenia, post-traumatic stress disorder, mood and anxiety disorders, and substance use disorder. A previous study in our lab demonstrated that repeated oxytocin administration can lead to reduced dopamine transmission in the mesolimbic pathway and a reduced dopaminergic response to psychostimulants in mice. These findings support the use of oxytocin to reduce drug-seeking behaviors (associated with dopamine release in the nucleus accumbens) and symptoms of anxiety (partially associated with dopamine and other excitatory neurotransmission in the amygdala). However, decreased dopamine is also related to symptoms of depression, such as reduced motivation and anhedonia, the inability to experience pleasure. The proposed study aims to determine whether repeated oxytocin administration alters anhedonia-related behavior. Mice will be given a subchronic pretreatment of either oxytocin or saline (control) prior to behavior tests. A saccharin preference test will be conducted in order to analyze the possible development of anhedonia. Mice that are not anhedonic will show a higher preference for

saccharin over tap water. Preference is determined by measuring how much saccharin is consumed in a two-bottle choice test and dividing by the total amount of fluid consumed. The results of the proposed study will improve our understanding of the behavioral outcomes of repeated oxytocin administration, ultimately providing further insight on the potential therapeutic uses of this drug.

Self-Regulation and Protective Behavioral Strategies as Mechanisms in the Relation Between Depression and Problematic Alcohol Use: A Serial Mediation Model

Kaeli Johnson

Mentor: Dr. James Murphy, Psychology

Alcohol use is among the most pressing issues among college students and is a public health burden in the United States. Depression rates are also high among college students and have been linked to alcohol-related problems, even when accounting for the level of alcohol use. Previous literature has shown that low use of protective behavioral strategies (PBS) during drinking occasions mediates the relation between depression and alcohol-related problems. Considering that PBS has been considered by some to be a drinking-specific form of self-regulation, and depression may be conceptualized as a disorder of self-regulation failure, we theorized that depression may be related to alcohol-related problems through the mediating processes of self-regulation and of PBS. We tested this hypothesis in the current study with a large sample of heavy drinking college students (N = 393) reporting at least two binge episodes in the past month (4/5+ standard drinks for women/men, respectively). We used baseline total scores for the Depression Subscale of the Depression, Anxiety, and Stress Scale (DASS), the Short Self-Regulation Questionnaire (SSRQ), the Protective Behavioral Strategies Scale (PBSS), the Young Adult Alcohol Consequences Questionnaire (YAACQ). We used the Daily Drinking Questionnaire (DDQ) to estimate typical weekly alcohol use.

Using a serial mediation model, we found that there was a significant indirect effect of depression on alcohol-related problems through self-regulation and PBS. We also examined models in which either self-regulation or PBS was the mediator while controlling for the other. When PBS was controlled for, self-regulation still significantly mediated the relation between depression and alcohol-related problems; whereas when self-regulation was controlled for, PBS did not. Altogether, this suggests that among heavy drinking college students, higher levels of depression are associated with reduced self-regulation, which may reduce their ability to effectively use PBS and may, in turn, increase their risk for experiencing alcohol-related problems. The findings provide preliminary evidence for self-regulation as a mediator between depression and PBS, accounting for part of the relation between depression and alcohol-related problems. This extends prior research which found that the use of PBS is useful for individuals with poor-to-average self-regulation in reducing alcohol-related problems. Poor self-regulation as a result of depression may affect motivation for, efficacy in, and awareness of PBS. For depressed students specifically, interventions targeting broader self-regulation, in addition to PBS, may be beneficial in reducing alcohol-related problems. Future research could use more fine-grained analysis to uncover in what way depression-induced poor self-regulation affects PBS, such as reduced motivation to use them, lowered sense of self-efficacy, or lack of awareness/attention to strategies available to them.

Examining the Impact of Stress During Adolescence and Adulthood on Dopamine Released Related to Addiction

Sophia Lemus

Mentor: Deranda Lester, Psychology

Early life stressors in childhood have been correlated with an increased likelihood of developing substance use disorder. Isolation during adolescence is a common model of early life stress in rodents. Preliminary studies from our lab have shown mice who had a nurturing and enriched adolescence exhibited a lower dopaminergic response to drugs of abuse relative to those who were isolated during adolescence. The proposed study aims to determine whether this isolation-induced effect on dopamine transmission can be reversed in adulthood, and whether isolation during adulthood alters dopaminergic transmission to the same degree as isolation during adolescence. In this study, one group of mice (n=9) will be raised in isolation (from weaning age to adulthood) and transferred into an enriched environment with cage mates for 6 weeks. Another group of mice (n=9) will be raised with cage mates (from birth to adulthood) and isolated for 6 weeks. In all mice, following the 6-week housing condition, dopamine release in the nucleus accumbens will be quantified using in vivo fixed potential amperometry prior to and following an injection of cocaine, a well-research dopamine agonist. We expect that the mice raised in isolation and transferred to an enriched environment will have a reduced dopaminergic response compared to mice raised in isolation, meaning that we expect that the 6-week period spent with cage mates will restore normal dopamine functioning. However, we do not expect that the isolation period during adulthood will alter the dopaminergic response to cocaine. Overall, these data will improve our understanding of the impact of environmental stressors on dopamine functioning as it relates to substance use disorder. Specifically, our findings will provide insight on the importance of aging and neural development on stress-induced alterations of the brain's reward pathway. The results of the present study may be useful for programs aimed at preventing and treating substance use disorder.

The Effects of Social Isolation on Anxiety and Addiction-Related Behaviors in Adolescent and Adult Mice

Serena Jones

Mentor: Deranda Lester, Psychology

In both humans and rodents alike, decreased social support and interaction have been correlated with an increased likelihood of developing anxiety and substance abuse disorder. Adolescence in particular is a time in which social isolation has shown to be the most stressful and detrimental in rodents. Our lab has previously used open field testing with mice to show that isolation during adolescence increases anxiety- and addiction-related behaviors. The proposed study aims to address 2 questions related to neural development and the impact of social isolation on these behaviors. 1) Can the behavioral effects of adolescent social isolation be reversed through social interaction in adulthood? 2) Does social isolation during adulthood have the same detrimental effect as social isolation during adolescence? In the proposed study, one group of mice (n=9) will be raised in isolation (from weaning age to adulthood), transferred to an enriched environment with cage mates for 6 weeks, and then in the open field chamber. A second group of mice (n=9) will be raised with cage mates (from birth to adulthood), transferred to an isolation condition for 6 weeks, and tested in the open field chamber. Open field testing will include measurements of

time spent in the center of the chamber (increased time in the center indicates reduced anxiety) and exploratory behaviors (locomotor activity and rearing, which correlate with drug seeking). Overall, the data will assist in understanding the impact of environmental factors, such as social interaction and stress, on anxiety- and addiction-related behaviors. The results of this study may be beneficial for programs aimed at preventing and treating anxiety and substance use disorder.

Inhibitory Control in Lphn3 Knockout Rats

Joshua Potter

Mentor: Dr. Helen Sable, Psychology

Attention Deficit Hyperactivity Disorder (ADHD) is characterized by deficits in inhibitory control and heightened impulsivity. By its self, impulsivity is believed to be associated with dopamine deficits in the brain, specifically in the medial prefrontal cortex. However, the mechanisms behind ADHD are not well understood.

Latrophilin 3 (Lphn3) is an adhesion g-protein coupled receptor (aGPCR) involved in signal transduction and overall synaptic stability. Previous literature has supported that the alteration of Lphn3 is associated with lowered dopamine levels like those seen in individuals with ADHD, as well as increased impulsivity behaviors associated with these lowered dopamine levels. Because of these similarities, it is suspected that the mechanisms of ADHD involve the Lphn3 gene.

To help understand the involvement of Lphn in ADHD, two groups of Sprague-Dawley rats will be subjected to a differential reinforcement of low rates task (DRL). A genetically unaltered wildtype (WT) group will act as the control, with Lphn3 knockout rats (KO) acting as the ADHD model in this study. It is suspected that Lphn3 knockout rats will have a lower ratio of reinforced to non-reinforced trials on the DRL test, indicative of lower inhibitory control.

Examining the Effect of Kratom on Dopamine Transmission Related to Abuse Liability

Lindsay Ringer

Mentor: Dr. Deranda Lester, Psychology

Mitragyna speciosa Korth (*M. speciosa*) is a tree that is part of the Rubiaceae family and is primarily found in tropical and subtropical regions of southeast Asia, Phillipines, and New Guinea. *M. speciosa* is commonly referred to as Kratom and has been known to possess both a stimulant effect as well as an opioid effect. Kratom has been used traditionally to treat intestinal infections, diarrhea, fever, and pain and has also been used for morphine dependence in Thailand as well as an opium substitute in Malaya. Kratom is currently legally available for purchase over the counter at smoke shops and convenient stores in most states, including TN. Mitragynine (MG) is the main psychoactive alkaloid accounting for 66% of the total alkaloid contents extracted from the leaves of kratom. Mitragynine is suspected to act on opioid receptors producing analgesia, sedation and euphoria effects, and also acts on monoamine receptors which produce the stimulant effect observed. Clinical trials have reported that the effects of kratom are dose-dependent with lower doses resulting in euphoric or stimulant effects, while higher doses result in opioid like effects. The mesolimbic pathway, or reward pathway, transmits dopamine from the ventral tegmental area (VTA) to the nucleus accumbens (NAc), and to the prefrontal cortex when activated resulting in the "rewarding" or pleasure effect. Drugs that cause an increase in extracellular levels of dopamine in the mesolimbic pathway, driving the reward response of the drug use, have been considered to have an abuse liability. In order to determine the potential abuse liability of kratom, the proposed

study will investigate the pharmacological effects of Mitragynine (MG) on dopamine levels in the mesolimbic pathway in mice. Due to the dose-dependent effects of MG, mice will be randomly assigned to three different experimental groups Mitragynine at 3 doses (1, 15, and 30 mg/kg) and one control group (saline). By way of in vivo fixed potential amperometry, real time dopamine release in the nucleus accumbens (NAc) will be measured in anesthetized mice before and after Mitragynine/saline administration. We hypothesize that Mitragynine will increase dopamine release at the lower doses and potentially decrease dopamine release at the higher dosage. This study will help to understand the neurochemical mechanisms of Kratom and the possible abuse liability of the drug.

Text Conflict Study

Sabriyya Shaw

Mentor: Dr. Jason Braasch, Psychology

Due to the vast amounts of information available on the internet today, many young people use the internet as a main source of learning. While this information is beneficial, due to the extensive availability of information, there is often a large amount of conflicting information. This conflicting information is presented in different contexts, two of which we will focus on the proposed study. The first type of conflicting text presentation is blocked presentation, where all of one side of the information at once, followed by all of the conflicting information. For example, if a student read one article that said that climate change is bad for the environment, and then they next read another article that states that climate change is good for the environment. The second type of conflicting text presentation is interleaved, where conflicting information is presented altogether. For example, if a student read an article that had information about how one critic says that climate change is good for the environment, while in the next sentence you have another critic who says climate change is bad for the environment. In trying to make sense of these conflicts, one of the strategies people use is "sourcing". Sourcing is when people attend to, evaluate, mentally represent, and use features of information sources, such as authors or publishers, in order to evaluate the reliability and validity of information presented. Metacognitive awareness is also a key aspect of successfully confronting conflicting information. Metacognitive awareness is characterized by the ability to understand and reflect one's own learning and thinking.

The proposed study examines the role of text presentation on metacognitive awareness and sourcing. Participants in the study will be middle school students, who will be tested on prior beliefs of vegetarianism, and will then be presented texts with conflicting information on the benefits of vegetarianism. Half of the participants will receive texts with blocked conflicting information on vegetarianism, with one text presenting sources giving information on the benefits of vegetarianism, while another text presents sources giving information against vegetarianism. The other half of the participants will be given interleaved conflicting information, with multiple sources giving information on the benefits of vegetarianism, while other sources are giving information against vegetarianism, all within the same text. Participants will then be given a topic belief survey, a metacognitive awareness survey, then will be asked to write an essay about their beliefs about vegetarianism. We will measure the mention of source in essay, metacognitive awareness, and mentions of conflicts.

We hypothesize that the interleaved text conflict presentations will result in higher metacognitive awareness, more mentions of conflicts in essays, and a greater use in sourcing (mention of sources) in the essay, compared to the blocked text conflict presentation.

Send Your Inner Lizard to Obedience School: Evaluating the Wim Hof Method As an Alternative Post-Traumatic Stress Treatment

Samantha Stemmer

Mentor: Dr. Margaret Landry, Social Work

Significant evidence supports the claim that alternative psychotherapy methods, specifically Eye Movement Desensitization and Reprocessing (EMDR) therapy, are revolutionizing the mental health field by alleviating post-traumatic stress symptoms through natural healing processes. These alternative psychotherapy methods access and reprocess the reptilian brain, or the basal ganglia, that is responsible for automatic self-preserving behavior patterns such as a trauma response. The Wim Hof method offers a promising potential for alleviating post-traumatic stress symptoms outside of a clinical setting by affecting the autonomic nervous system and the immune system through cold therapy, breathing, and commitment. Through comparative research between EMDR therapy and the Wim Hof Method, the benefits and limitations of the Wim Hof Method can be thoroughly measured. The National Center for PTSD reports that 7-8% of the U.S. population will experience post-traumatic stress within their lifetime. The mental health field is rapidly expanding and challenging the methods of conventional mental health practices in hopes of increasing the quality of life for sufferers of post-traumatic stress. Alternative practices such as the Wim Hof Method show concrete evidence in effectively stabilizing sufferers of a diverse array of physiological ailments and could be a critical tool for post-traumatic stress research and understanding.

A Study of Social Influence and Conforming Behaviors: Inducing Peer Pressure with Preferential Judgements Measured by Computer Mouse Tracking Technology

Kristen Mae Talens

Mentor: Dr. Gina Caucci, Psychology

This research project has the intention of looking at the impact of social influence on the decision-making process. Within the literature, the standard methodology for studying conformity is the basic paradigm created by Asch in the 1950's (Asch, 1955). This paradigm consists of asking participants about an objective judgement task and comparing their responses when presented with dissenting opinion. This operational definition of conformity tends to limit the research on the effects of conformity in decision making. Within this study, conformity behavior will be measured using computer mouse tracking technology to see if peer pressure induces conforming behaviors when presented with a preferential judgement task, which involves choosing one's preferred image between two alternative images on a screen. Conforming behavior is prevalent within everyday interactions for society at large. However, the literature lacks adequate research that looks at whether conformity acts as a mediating mechanism to affect or alter observable behaviors. Within this study, conformity behavior will be measured using computer mouse tracking technology in order to test this theory that our cognitive processes, such as decision making, can be measured in our movement. Normative information will be presented in the form of text that says a majority percentage of participants preferred one image over another, ideally, inducing peer pressure on the participant. It is predicted that there will be a difference in computer mouse movement patterns when presented with trials inducing social influence when compared to the baseline. Specifically, that trials with an induced sense of peer pressure will show the most signs of hesitation in mouse movements and deviations from ideal mouse trajectories. Thus, giving support that peer pressure can alter our behaviors that

ultimately reflect conformity. The goal of this research project is to fill a gap within the social and cognitive literature to research how social influences mediate in conformity and ultimately impact individuals' decision-making behavior. Data collection and analyses is currently underway and pilot data has been collected.

Whataboutisms, Refutations, and the Misinformation Effect

Katherine Zerit

Mentors: Dr. Jason Braasch, Psychology; Dr. Stephanie Huetten, Psychology

Previous research has found that with the aid of refutational texts, the spread of incorrect information has decreased significantly. Whataboutisms are statements used to distract from a primary subject. Through today's media, whataboutisms have been used especially to influence political opinions. The purpose of this study is to analyze the ways in which whataboutisms affect the spread of misinformation when paired with refutational texts. Participants will be given a prior knowledge exam in which they will be instructed to read and answer 24 misconceptions in psychology framed by true and false questions. The purpose of this is to show the difference between what individuals believed before and after completing the experiment and compare them. Afterwards, the participants will read 24 short passages involving common misconceptions in psychology as stated in the prior knowledge exam. Incorrect texts for the current study are in the forms of stories and involve multiple characters discussing a misunderstanding concerning psychology in which they are seeking information. Texts also could contain a refutation (i.e., a statement contesting the misconception), a whataboutism, both, or neither. The neither condition reflects only inaccurate information and will act as the control. The post tests will be identical to the pretest and will have 24 statements reflective of the texts previously read. For each statement, they will make a true/false judgment and will provide a confidence rating in the accuracy of that response. Responses will be aggregated as number of accurate true/false responses and level of confidence responses. The post tests will be identical to the pretest and will have 24 statements reflective of the texts previously read. For each statement, they will make a true/false judgment and will provide a confidence in the accuracy of that response. Responses will be aggregated as number of accurate true/false responses and level of confidence responses. A confidence rating and need for cognition survey will also be included as individual reader characteristics. The results will be analyzed using a 3 x 2 within subjects ANOVA and we predict that the refutational condition will produce more learning gains than the control and the whataboutism condition. A one-way ANOVA will measure confidence and we predict that the refutation condition will produce a high score in the confidence ratings than the control or whataboutism condition. Finally, we will explore the correlations of the need for cognition and learning and confidence for each of the three conditions. We will use a Pearson's r correlation to analyze the relationship.