Celebrating
THE LIBERAL ARTS
RHODES SYMPOSIUM

APRIL 26, 2019

April 26th Events

- Awards Convocation: 9:00 a.m., McNeill Concert Hall in West Campus
- Poster Session I & Lunch Reception, 11:30 a.m.-1:30 p.m., Multi-Sports Forum of the Bryan Campus Life Center
- Oral Presentation Sessions: 11:00-5:00 p.m., various locations
- Poster Session II & Closing Reception: 4:00-6:00 p.m., Multi-Sports Forum of the Bryan Campus Life Center

Acknowledgements and Special Thanks

- Communications, Rhodes Symposium program cover design and online abstract submissions
- Leah Ford, Office of Academic Affairs
- Meaghan Pickles, Rhodes Student Associate for Fellowships, Creation of program, coordinating, communications

URCAS Planning Committee

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- Jaqueline Oliveira, Assistant Professor, Department of Economics
- David Pike, Assistant Professor, Department of Biology
- Dhammika Muesse, Assistant Professor, Department of Chemistry
- Vanessa Rogers, Assistant Professor, Department of Music and Theater
- Courtenay Harter, Associate Professor, Department of Music and Theater
- Caroline Magee, Class of 2019
- Ashmeet Singh, Class of 2019

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Celebrating THE LIBERAL ARTS
RHODES SYMPOSIUM

UNDERGRADUATE RESEARCH & CREATIVE ACTIVITY SYMPOSIUM

FRIDAY, APRIL 26

SCHEDULE BY DIVISION

Poster Sessions will be held in the Multi-sports Forum of the BCLC
11:30 AM-1:30 PM & 4:00-6:00 PM

TIME	ROOM	SESSION TITLE	DEPARTMENTS/PROGRAMS
		FINE ARTS	
12:30-2:00	CLOUGH 302 BARRET LIBRARY BASEMENT BRYAN CAMPUS LIFE CENTER	DIGITAL ART SHOWCASE	ART & ART HISTORY
1:30-2:30	TUTHILL PERFORMANCE HALL	THE CAUTHEN COMPETITION	MUSIC
2:00-3:20	HASSELL HALL 100	ART HISTORY ORAL PRESENTATIONS	ART & ART HISTORY
2:30-3:30	TUTHILL PERFORMANCE HALL	NATIONAL ASSOCIATION OF TEACHERS OF SINGING	MUSIC
3:30-4:00	MCCOY THEATRE	NEW AMERICAN PLAYS RESEARCH FELLOWSHIP	THEATRE
4:00-4:30	MCCOY THEATRE	SCREENPLAY INTENSIVE	THEATRE
		HUMANITIES	
11:00-12:30	BUCKMAN 200	THE RHODES HISTORICAL REVIEW	HISTORY
11:30-1:15	LANGUAGE LEARNING CENTER	SPANISH SENIOR SEMINAR I	MODERN LANGUAGES & LITERATURES
1:00-2:00	BUCKMAN 200	HISTORY OF THE 20TH CENTURY	HISTORY
1:00-2:00	SOUTHWESTERN HALL 210	CHURCHES, RETREATS, & VAMPIRES: RELIGIOUS STUDIES SENIOR SEMINAR	RELIGIOUS STUDIES
1:30-2:15	SOUTHWESTERN HALL 207	ART & THE BIBLE	ART HISTORY & RELIGIOUS STUDIES
1:30-3:00	LANGUAGE LEARNING CENTER	SPANISH SENIOR SEMINAR II	MODERN LANGUAGES & LITERATURES
2:30-3:15	SOUTHWESTERN HALL 207	THEORY & STRUGGLE IN ALGERIA	HISTORY
2:30-3:30	SOUTHWESTERN HALL 210	PHILOSOPHY: SEX, SOUND & DISOBEDIENCE	PHILOSOPHY
3:30-4:30	SOUTHWESTERN HALL 207	RUSSIAN LANGUAGE & THOUGHT	MODERN LANGUAGES & LITERATURES
3:30-5:15	LANGUAGE LEARNING CENTER	ANCIENT *ARTES*: GREEK & ROMAN STUDIES SENIOR SEMINAR	GREEK & ROMAN STUDIES

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NATURAL SCIENCES			
1:30-2:30	ROBERTSON 110	HONORS CHEMISTRY RESEARCH	CHEMISTRY
1:30-2:15	FJ-D	THE NATURAL WORLD	BIOLOGY
1:30-2:15	FJ-C	THE PHYSICAL WORLD	PHYSICS
1:30-2:15	FJ-A	NOVEL APPS I	MATHEMATICS & COMPUTER SCIENCE
2:30-3:00	FJ-D	COMPUTATIONAL MODELING I	PHYSICS, MATHEMATICS & COMPUTER SCIENCE
2:45-3:30	ROBERTSON 110	MOLECULAR MODELING	CHEMISTRY
2:30-3:15	FJ-C	THE VIRTUAL WORLD	MATHEMATICS & COMPUTER SCIENCE
2:30-3:15	FJ-A	MEDICINAL SCIENCE	BIOLOGY, MATHEMATICS & COMPUTER SCIENCE
3:30-4:15	FJ-D	COMPUTATIONAL MODELING II	PHYSICS, MATHEMATICS & COMPUTER SCIENCE
3:30-4:15	FJ-C	NOVEL APPS II	MATHEMATICS & COMPUTER SCIENCE
3:30-4:15	FJ-A	NOVEL APPS III	MATHEMATICS & COMPUTER SCIENCE
3:45-4:45	ROBERTSON 110	MODELING & CATALYSIS	BIOCHEMISTRY & MOLECULAR BIOLOGY
SOCIAL SCIENCES			
1:15-2:45	CLOUGH 204	ANTHROPOLOGY & SOCIOLOGY I	ANTHROPOLOGY & SOCIOLOGY
2:00-3:00	BUCKMAN 200	POLITICAL SCIENCE & INTERNATIONAL STUDIES	POLITICAL SCIENCE & INTERNATIONAL STUDIES
2:30-3:30	BUCKMAN 108	EMPIRICAL ECONOMICS RESEARCH I	ECONOMICS
3:00-4:30	CLOUGH 204	ANTHROPOLOGY & SOCIOLOGY II	ANTHROPOLOGY & SOCIOLOGY
3:45-4:30	BUCKMAN 108	EMPIRICAL ECONOMICS RESEARCH II	ECONOMICS
4:15-5:00	CLOUGH 417	INTERDISCIPLINARY TOPICS	MATHEMATICS & COMPUTER SCIENCE, PSYCHOLOGY, URBAN STUDIES, AFRICANA STUDIES, HISTORY



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BUCKMAN HALL	11:00-12:30	200	RHODES HISTORICAL REVIEW
BUCKMAN HALL	1:00-2:00	200	HISTORY OF THE 20TH CENTURY
BUCKMAN HALL	2:00-3:00	200	POLITICAL SCIENCE & INTERNATIONAL STUDIES
BUCKMAN HALL	2:30-3:30	108	EMPIRICAL ECONOMICS I
BUCKMAN HALL	3:45-4:30	108	EMPIRICAL ECONOMICS II
CLOUGH HALL	1:15-2:45	204	ANTHROPOLOGY & SOCIOLOGY I
CLOUGH HALL	3:00-4:30	204	ANTHROPOLOGY & SOCIOLOGY II
CLOUGH HALL	4:15-5:00	417	INTERDISCIPLINARY TOPICS
FRAZIER-JELKE	1:30-2:15	FJ-A	NOVEL APPS I
FRAZIER-JELKE	1:30-2:15	FJ-C	THE PHYSICAL WORLD
FRAZIER-JELKE	1:30-2:15	FJ-D	THE NATURAL WORLD
FRAZIER-JELKE	2:30-3:00	FJ-C	THE VIRTUAL WORLD
FRAZIER-JELKE	2:30-3:15	FJ-A	MEDICINAL SCIENCE
FRAZIER-JELKE	2:30-3:15	FJ-D	COMPUTATIONAL MODELING I
FRAZIER-JELKE	3:30-4:15	FJ-D	COMPUTATIONAL MODELING II
FRAZIER-JELKE	3:30-4:15	FJ-C	NOVEL APPS II
FRAZIER-JELKE	3:30-4:15	FJ-A	NOVEL APPS III

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HASSELL HALL	2:00-3:20	100	ART HISTORY ORAL PRESENTATIONS
HASSELL HALL	2:30-3:30	TUTHILL PERFORMANCE HALL	NATIONAL ASSOCIATION OF TEACHERS OF SINGING
MCCOY THEATRE	3:30-4:00	MCCOY THEATRE	NEW AMERICAN PLAYS RESEARCH FELLOWSHIP
MCCOY THEATRE	4:00-4:30	MCCOY THEATRE	SCREENPLAY INTENSIVE
SOUTHWESTERN HALL	11:30-1:15	LANGUAGE LEARNING CENTER	SPANISH SENIOR SEMINAR I
SOUTHWESTERN HALL	1:00-2:00	210	CHURCHES, RETREATS, & VAMPIRES: RELIGIOUS STUDIES SENIOR SEMINAR
SOUTHWESTERN HALL	1:30-2:15	207	ART & THE BIBLE
SOUTHWESTERN HALL	1:30-3:00	LANGUAGE LEARNING CENTER	SPANISH SENIOR SEMINAR II
SOUTHWESTERN HALL	2:30-3:15	207	THEORY & STRUGGLE IN ALGERIA
SOUTHWESTERN HALL	2:30-3:30	210	PHILOSOPHY: SEX, SOUND & DISOBEDIENCE
SOUTHWESTERN HALL	3:30-4:30	207	RUSSIAN LANGUAGE & THOUGHT
SOUTHWESTERN HALL	3:30-5:15	LANGUAGE LEARNING CENTER	ANCIENT *ARTES*: GREEK & ROMAN STUDIES SENIOR SEMINAR
ROBERTSON HALL	1:30-2:30	110	HONORS CHEMISTRY RESEARCH
ROBERTSON HALL	2:45-3:30	110	MOLECULAR MODELING
ROBERTSON HALL	3:45-4:45	110	MODELING & CATALYSIS



SOCIAL SCIENCE ORAL SESSIONS

Political Science and International Studies
2:00-3:00 pm
Buckman 200
Moderator: Renee Johnson

2:00-2:15 pm *Cracking the Glass Border: The Refugee Status Determination Process for Women Fleeing Gender-Based Persecution*
Lillie Stephens
Faculty Sponsor: Amy Risley, Department of International Studies
Since the 1951 Convention Relating to the Status of Refugees, the United Nations and participating countries have established an international refugee regime. Although the Convention's signatories agreed on a standard definition of "refugee," states retained their autonomy to design and define their own refugee status determination (RSD) processes. As a result, countries have adopted different policies on gender-based asylum claims and developed varying levels of consistency in the RSD process. What factors have led to this varying consistency in the RSD process? To answer this question, I compare legal developments in the RSD process for gender-based asylum in Canada, the United States, and Australia. I define two types of consistency: between international and domestic standards and in the adjudication of asylum claims. My research proposes three independent variables that explain this variation in consistency: levels of respect for international human rights norms, levels of marginalization of women in society and in the RSD process itself, and levels of fragmentation of the RSD process. This study seeks to contribute to the existing literature on this topic by not only describing the challenges faced by women seeking asylum for gender-based persecution, but by explaining the factors that lead to these additional challenges.

2:15-2:30 pm *Just Say No (to the War on Drugs): The Racial Implications of the War on Drugs*
Connor Hurley
Faculty Sponsor: Anna Eldridge, Department of Political Science
The War on Drugs, since the late 1960's, has been a mainstay of American politics. In a general sense, the drug war is an amalgamation of federal and state policies aimed at eliminating illegal drug use, combatting drug-related violent crime, and curtailing drug-based commerce. While the publicly-stated goals of the War on Drugs – fighting crime and promoting healthier, safer living – remain popular, the motivations at the heart of national policies has much more sinister intentions and effects. Despite the claim that the tough-on-crime laws are supposedly written in a neutral manner, they are applied in a way that dramatically effect black and brown people on a disproportionate basis. However, even within some laws themselves, evidence of racial bias is present. Instead of consistently locking up the sellers and manufacturers of dangerous drugs,

criminal laws and their enforcement by federal and state law enforcement are unequally applied to incarcerate mostly-black, mostly-male drug users in America's poorest neighborhoods. This paper will discuss the troubled history of America's drug war with a focus on the effects of mass incarceration and the role of the justice system. I will also propose policy changes that hope to end the harsh effects of the War on Drugs.

2:30-2:45 pm *South Korea's Demographics & National Security: How the Asian Tiger Grew its Teeth*

Joon Hwang

Faculty Sponsor: Jennifer Sciubba, Department of International Studies

With tensions rising in the Korean peninsula, South Korea's national security remains a paramount concern for its key ally, the United States. Although demographics affects countries in slow, gradual ways, it undoubtedly a potent force in determining national security. We examine South Korea's demographics from 1945 to the current day, specifically looking at its demographic transition, declining fertility, a mature age structure, and increasing migration. Postwar Korea's decreasing fertility facilitated economic development and military strengthening; today's lowest-low fertility levels are decreasing military manpower but increasing the role of advanced technology, efficient organization, and the U.S.-Korea alliance within military security. Rapid population aging and the growing yet inadequate welfare system are causing widespread elderly poverty, crowding out defense spending. As for immigration, the surge of foreign labor is benefiting the economy but keeping out domestic workers, causing discontent against the regime. Korea's low fertility, rapid aging, and growing immigration has had mixed effects on its military, regime, and structural security, and the future is not much clearer.

2:45-3:00 pm *But, Think of the Children: A Culture of Cutting Corners for Convictions in the Juvenile Court of Memphis and Shelby County*

Connor Hurley

Faculty Sponsor: Renee Johnson, Department of Political Science

Outside of the public-school systems in Shelby County, the agency that most directly affects minors is the Juvenile Court of Memphis and Shelby County (JCMSC). Beginning in 2009, the Department of Justice began a civil rights investigation into the conduct of the JCMSC that eventually determined that the constitutional rights of many of the children appearing before the Court were being ignored or abused. After extended monitoring by appointed third-party officials, an agreement put forth by former-County Mayor Mark Luttrell and former-Attorney General Jeff Sessions ended the federal presence at the JCMSC in late 2018. Now, with a new county mayor and a community that has harshly criticized the move to end oversight, the JCMSC has become an interesting case study into how bureaucracies interact with each other and the community. The focus of this paper will be to discuss the past and present circumstances of the

policies of the JCMSC, as well as how the Department of Justice has influenced the local court. Additionally, I will discuss how the 2018 Shelby County Mayoral Election and the different administrations have redefined the goals of the JCMSC.

Empirical Economics Research I
2:30-3:30 pm
Buckman 108
Moderator: Jaqueline Oliveira

2:30-2:45 pm *Investigating the Gender Gap Among Actors Across the U.S.*
Austin Barringer
Faculty Sponsor: Jaqueline Oliveira, Department of Economics
We use US census data on total personal income, sex, and city/state of residency coupled with US archives data on presidential elections to explore if the wage differential among actors by sex changes after major political movements.

2:45-3:00 pm *The Effects of Air Pollution on Human Capital: A Study of Workers in the U.S.*
Samuel Crowell
Faculty Sponsor: Jaqueline Oliveira, Department of Economics
The negative effects of air pollution on health have been extensively studied. As health is a large determinant of labor productivity, it is hypothesized that air pollution also has a negative effect on several measures of productivity. I will analyze the connection between changes in air pollution in the one to three-year time horizon and wages, hours worked, and whether or not a worker was present the previous week. It is believed that if decreases in productivity are present, they can be attributed to either decreases in one's own health or decreases in the health of one's dependents. This paper attempts to generalize findings from outdoor laborers to workers both indoors and out.

3:00-3:15 pm *The Effects of Conditional and Unconditional Cash Transfers in Indonesia*
Etta Danielson
Faculty Sponsor: Jaqueline Oliveira, Department of Economics
Direct cash transfers to households have become a prominent method of poverty alleviation, particularly in developing countries. Their growing prevalence has led to the debate as to whether conditional or unconditional cash transfers are preferable. While conditional transfers stipulate certain educational and health outcomes, there are both practical and philosophical objections to the conditions they put on households. Indonesia introduced an unconditional cash transfer program in 2005, which was then replaced by a conditional program in 2007. The Indonesian Family Life Survey (IFLS) provides data on households throughout the country, allowing analysis of the programs' results. This paper exploits the longitudinal data from the

IFLS in order to empirically study the long-term effectiveness of the cash transfer programs in Indonesia and compare them.

3:15-3:30 pm *Analyzing the Effect of Institutions' Athletic Success on Academic Performance*
Adam Hearn
Faculty Sponsor: Jaqueline Oliveira, Department of Economics
Beginning each year around August, prospective college-goers begin filling out their applications to send off to institutions where they may end up for the next four years. The elements that go into this decision include the academic quality of the institution, the campus climate, and for some, the athletic successes the school has achieved in previous years. My research focuses on the last of these elements, as I will assess how collegiate athletics at the highest level impact post-secondary academic metrics such as applications, first-year enrollment and graduation rates. In doing so, I will be adding to the vast literature on the topic, utilizing various elements from several publications while incorporating new metrics that have yet to be studied, such as differences by gender and region.

Empirical Economics Research II
3:45-4:30 pm
Buckman 108
Moderator: Jaqueline Oliveira

3:45-4:00 pm *The Effects of Single-Sex Schooling on Math Achievement*
Yanxin Li
Faculty Sponsor: Jaqueline Oliveira, Department of Economics
Math-intensive fields such as engineering and computer science have received increasingly more attention for their critical role in maintaining a nation's competitiveness in the global economy. Single-sex schooling has been proposed to improve the efficiency of math education. Specifically, it is hypothesized that single-sex schooling protects girls from discouraging gender stereotypes and promotes math involvement. This paper will investigate the effects of single-sex schooling on high school students' math achievement. Special attention will be paid to how boys and girls may respond to single-sex schooling differently.

4:00-4:15 pm *Brand Reputation and Perceived Quality of Champagne AOC for the U.S. Millennial Wine Consumer*
Margaux Moze
Faculty Sponsor: Jaqueline Oliveira, Department of Economics
This study aims to examine the extent to which Champagne's reputation is recognized by Millennials through a blind tasting of a Champagne and non-Champagne sparkling wine. Participants decided which wine had the most appealing appearance, smell, and taste, as well as which wine was more expensive and which they thought was the Champagne. Many interesting

conclusions resulted, including that a significant proportion of Millennials cannot differentiate a Champagne from a non-Champagne. To maintain its reputation of quality in the United States' shifting wine market demographics, the Champagne region must better educate Millennials on identifying and differentiating Champagne from other sparkling wines.

4:15-4:30 pm *Do You Truly Get What You Pay For? Understanding the Relationship Between College Tuition Costs and Career Earnings*
Zachary Scott
Faculty Sponsor: Jaqueline Oliveira, Department of Economics
Studies on the cost of college tuition on monetary earnings for adults in the United States have been prevalent since the 1980's. With that being said, less has been researched about this effect during the 21st century where tuition costs are increasing at a staggering rate. In this project I will focus on the most recent data available from the U.S Department of Education, specifically from 2017. Using this data I will provide estimates on the impact of college tuition costs, a proxy for the prestige of education, on one's earnings after college. As a result, my discoveries will be used to assess whether it is worth paying more to go to a highly ranked institution, or if it in fact is more economical to go to a less expensive institution.

Anthropology and Sociology I
1:15-2:45 pm
Clough 204
Moderator: Susan Kus

1:15-1:30 pm *You'll Get a Kick Out of This*
Gordon Webb
Faculty Sponsor: Susan Kus, Department of Anthropology & Sociology
This ethnographic study examines Midtown Taekwondo in Memphis, Tennessee. The importance of an ethnographic study is to gain an understanding of another cultural scene. This can mean traveling to another country, or simply engaging with a new group of people. The key is to construct some sort of systematic knowledge of other groups of people through in-depth conversations and participant observation. The purpose of this study is to examine the cultural scene at Midtown Taekwondo, a family-owned martial arts academy. Throughout the process, I gained a new understanding of the Memphis community through the lens of martial arts. Midtown acts as a Memphis intersection where people from various areas around Memphis come to meet. Throughout my research, I have obtained better perspective on this small and very specific community in the greater Memphis community. Spreading the knowledge I have recorded about these martial artists, their interactions and practices can lead to better ways of understanding and practicing acceptance of all people and groups of people within the city.

1:30-1:45 pm *Social Safari: An Ethnographic Study of the Memphis Zoo*
Erin Dempsey
Faculty Sponsor: Susan Kus, Department of Anthropology & Sociology
For anyone who tries to understand how a particular culture operates, the method of participant observation can allow them to gain a deeper understanding and appreciation for the culture they are studying. By being a participant observer, researchers can form deeper relationships with the data being collected and the people they collected it from. Understanding such complex relationships also can help researchers to convey more meaningful analyses of a culture to their audiences. The purpose of this study, specifically, was to illuminate the underlying culture at the Memphis Zoo by utilizing the ethnographic method of participant observation. Through conducting this ethnography, I was able to better familiarize myself with the ethnographic method of participant observation so that I may be better able to provide an authentic representation of this particular culture. By situating myself as a patron and volunteer, I was able to gain a valuable perspective of the material and sensuous aspects of the zoo, as well as important themes within the zoo's culture. I was able to find that the Memphis Zoo is a cultural hotspot where people can formulate ideas of community and education, and I found that through educational events such as the seasonal Lego exhibit, material culture played a strong role in the education and community of the zoo's patrons. I found that the sensuous appeal of seasonal exhibits, as well as the actual animal exhibits, provides a fun and relaxing social setting for patrons while also informing them about important conservation issues.

1:45-2:00 pm *Transcending the Physicality of Touch: An Ethnographic exploration of Material Culture within Ebbo's Spiritual Supply House*
Amaree Austin
Faculty Sponsor: Susan Kus, Department of Anthropology & Sociology
Ethnography functions as a method of learning, examining, and understanding culture through the natives of an Othered space. One of the purposes of ethnography is to compel readers and ethnographers to reflect on their own cultural limitations. In this study, I found opportunity at Ebbo's Spiritual Supply House to confront these limitations, and investigate the possibility of religious and spiritual fluidity situated in the Bible- belt of the Mid-South. Ebbo's Spiritual Supply House establishes a diverse and inclusive space in which patrons that practice and belong to various spiritual and religious traditions range across the board from Hoodoo, Baptist-Christianity, Witches, Satanist, Buddhist, to Santeria practitioners, and so on. Keeping in mind that my field site is Ebbo's Spiritual Supply house, I have come to understand that communicating the harmonious flow of energy the natives believe attract and sustain the shop are best exemplified through prose and poetry. It is through the metaphoric translation of prose and poetry that I personify the way patrons of the space engage with material culture in the shop like crystals, candles, oils, incense, and tarot cards. With attention to the engagement of the all of the senses that the shop inspires, this project places a particular focus on the intimacies that

derive from touch. This study develops a focus on the sensual, or the metaphorical sense of touch that transforms spiritually into feeling; ultimately it is the cultural experience of this feeling that cultivates peace and protection for the patrons of Ebbo's.

2:00-2:15 pm *The Social Rules of Fight Club: An Ethnographic Study of Midtown Krav Maga*
E Theeke
Faculty Sponsor: Susan Kus, Department of Anthropology & Sociology
The ethnographic method emphasizes the essentiality of immersing oneself in the social or cultural situation being studied through careful observation and, whenever possible, participation. Through participating as a beginning level student at Midtown Krav Maga, a local martial arts gym in Midtown Memphis, I am learning how to employ the ethnographic method in order to better understand an unfamiliar setting. Despite my initial assumption that the setting would be more formal like many other martial arts schools I have encountered, Midtown Krav Maga has a very laid back and friendly atmosphere that permeates the community it houses. Participants and instructors can be observed teasing each other about their lives outside of the gym just as often as they offer pointers on drills, and regardless of skill and experience every participant is always ready to offer whatever support or snarky remark they have to anyone in need of one. In the end, it became clear that it is every bit as important to be able to take a joke as it is to take a punch.

2:15-2:30 pm *Dice Rolls and Pieces of Cardboard: An Ethnography of The Greater Memphis Magic Arena*
Jacob Sullivan
Faculty Sponsor: Susan Kus, Department of Anthropology and Sociology
The ethnographic method involves both observation and participation within a cultural group. The ethnographer's job is to ethically examine the position of an othered group through both observation and participation. This method is particularly useful in finding new insights on people and spaces in which one might be unfamiliar with. Unlike a journalist, the ethnographer does not infiltrate the cultural space, rather they become part of it. In my own ethnography, I examine a community of people who play different types of games together in the city of Memphis. The Greater Memphis Magic Arena is a space in which gamers come together to not only play cards with one another, but also to be a part of a very vibrant and social community. As a long time gamer myself, the prospect of deeply investigating a site designed for gamers using the ethnographic method is exciting to me. For this project, I focus on the ways in which the ethnographic method came together to help me understand dynamics around race, gender, and materiality in this gaming community. In doing so, I hope to show that the community itself is unique. The ethnographic method itself was invaluable in my interactions with the people in this community and as a result I argue that the methodology itself is most valuable. In examining

the gaming community in Memphis, I hope to dispel antisocial stereotypes about gamers as the games in which they play are social endeavors.

2:30-2:45 pm *Keeping it Abstract: An Ethnographic Study of the Galleries at Crosstown Arts*
Avery Budin
Faculty Sponsor: Susan Kus, Department of Anthropology and Sociology
This semester I have been engaged in an ethnographic study of the art galleries at the Crosstown Concourse. The ethnographic method used involved participant observation of a cultural scene, visited by locals and out-of-town guests alike. Observation is defined as the systematic description of events, behaviors, and artifacts in the social setting which enable the researcher to describe existing situations using the five senses. In order to establish a community and better connect artists, the creative process, and contemporary works of art to the city of Memphis and its patrons, Crosstown Arts houses 7,000 square feet of exhibition space. In an effort to involve a wide range of local participation the galleries host a yearly roster of ten exhibitions, all of which are on display one month at a time. My study aims to observe how visitors in the space interact with and interpret the art, while simultaneously engaging with the art myself. As a result, I was able to gain a sense of the importance art holds in the lives of various individuals. The space welcomes people of all ages with a target population of individuals under 50 and college students interested in visual arts and amateur modeling. I have had the privilege of interviewing visitors from around the country, gaining insight into the material culture that exists among art enthusiasts and average community members alike. My ethnographic study has allowed me to pose the question: What draws individuals to or deters them from particular pieces of art?

Anthropology and Sociology II
3:00-4:30 pm
Clough 204
Moderator: Susan Kus

3:00-3:15 pm *Yoga is for Posers: An Ethnographic Study of Delta Groove Yoga*
Jorie Moran
Faculty Sponsor: Susan Kus, Department of Anthropology and Sociology
Ethnography is a method of anthropological research that allows a researcher to immerse themselves in a particular social situation in order to understand the culture. By means of utilizing this technique, I was able to learn the practice of yoga while also learning about the culture. Fixed in Overton Square, a vibrant area within Midtown, I, for several weeks, attended Vinyasa and Yin yoga classes. I was among fellow Memphians who were also learning, at different paces and levels of experiences. While the studio itself is a small space, it attracts a diverse and fairly extensive group of individuals where no class is ever the same size or structure. Once I grew comfortable with the space, I focused on the members who frequented the

studio and their relationship with one another as well as with the instructor. As a result, I grew to understand the purpose of practicing yoga by means of these interactions. I was then able to better understand the impact of yoga for those that practice and even more so, how the various styles of yoga influence the audience it captivates most.

3:15-3:30 pm *But First, Coffee: An Ethnographic Study at City & State*
Lauren Boots
Faculty Sponsor: Susan Kus, Department of Anthropology and Sociology
The ethnographic method teaches that one can't understand the meaning behind a lifestyle until they themselves experience it. Studying a culture apart from your own can be challenging especially when you think you have an understanding of it. It being something so central, and vital, to everyday life: a cup of coffee. As a result, one needs to pay particular attention to the sensuous details of the entire cultural space to deeply understand it. Seeking to understand the lifestyle of a coffee enthusiast is only truly possible by immersing yourself in the culture. Participating in the consumption of this widely adored addiction has been eye-opening, as well as mouth-tingling. The sensation of the uniquely-crafted brews and deeply-symbolized environment is more complex that expected. The findings can only be discovered with excellent observation and attention to detail. This study allowed me to consider that which is beyond initial sight and sounds. It also challenged me to not accept a common human practice, but rather continue to question and analyze that which is the norm. Questioning even the most mundane habits in this world can reveal the most intriguing insights. This research has taught me to challenge the obvious, accept the uncertain, and embrace the simplicity. As a 22-year-old college senior who now relies on coffee for my daily dose of energy, I may be transformed into a coffee enthusiast and have found the secret to such a lifestyle beyond needing energy to keep me going.

3:30-3:45 pm *A Diamond in the Ruff: An Ethnography of Overton Bark*
Emma Pickard
Faculty Sponsor: Susan Kus, Department of Anthropology and Sociology
The purpose of the ethnographic method is to produce accurate representations of various cultures and beliefs from the perspective of the subjects being studied. Through their work, ethnographers gain insight necessary for understanding cultures that are different from their own. In doing so, ethnographies force us to question our own assumptions and cultural biases. I employed this style of research for my own study of Overton Bark, a public dog park located in Midtown, Memphis. My research was inspired by the rich history of companionship between humans and dogs as well as my own relationship that I share with my dog. I utilized participant observation to actively engage with the community and brought my Labrador puppy with me to fully immerse myself within the cultural scene. In fact, my dog helped me spark various conversations with people in the space. Through my observations and interactions, I have gained insight into Overton Bark's unique atmosphere. The objective of my study was to explore the

comings and goings of the park itself, the participants who enjoy the park, and the "rules of the park." I have developed a greater appreciation for the relationships that humans share with dogs and an understanding of what Memphians gain from their time spent at Overton Bark.

3:45-4:00 pm *Why Memphis Rocks: An Ethnographic study of Memphis Rox*
Marlena Roberson-Bullard
Faculty Sponsor: Susan Kus, Department of Anthropology and Sociology
Rock climbing is not just a sport; it involves skill and technique in order to gain an understanding of one's bodily strength and coordination. The ethnographic approach consists of participation and observation between the observer and the surrounding cultural space. Within the heart of south Memphis sits a rock climbing facility with the name of Memphis Rox. The facility was built to provide a safe-haven and positive space for those living in challenging and poverty-stricken areas. Due to the overwhelming amount of support, Memphis Rox has been able to cultivate a community within itself. The facility is able to foster relationships across cultural, racial, ethnic, and socio-economic backgrounds. Using the ethnographic method, I was able to immerse myself into a cultural space I was unfamiliar with. In doing so, Memphis Rox transforms into a familial community where rock climbing creates a sense of stress relief, comfort, and security that contributes to the cultural space and those who inhabit it.

4:00-4:15 pm *Breaking the Mold: An Ethnographic Study of Baucum Pottery*
Veronica Kilanowski-Doroh
Faculty Sponsor: Susan Kus, Department of Anthropology and Sociology
There is a Taoist saying which states that a pot is not useful for what it is, but rather what it holds. In my ethnographic study of Baucum Pottery, I have discovered that the works of pottery themselves holds multitudes of stories. Using the ethnographic method, I have been able to immerse myself into the physical production space of a small-scale pottery shop. The ethnographic method focuses upon becoming a part of a cultural space in order to better understand it. This pottery shop is an anomaly in the modern United States culture of mass production. In my ethnographic study, I look at the ways in which this local shop has functioned as a part of the Memphis community for over 40 years. I also explore how the life and experience of an artist influences their work and how they interact with their consumers in this creative process. People who want unique work with a personal touch seek out Baucum Pottery. They see what the significance of a pot before it is filled can be. There is value in the production of the object, not just in the use of the object itself.

4:15-4:30 pm *"Mama's" family store: An Ethnographic study of a Gas Station Super Mart*
Giulia Russell
Faculty Sponsor: Susan Kus, Department of Anthropology and Sociology

A gas station is possibly one of the most stimulating places I have ever had the pleasure of observing. For my ethnography I spent many hours with the patrons and owner of a gas station in Memphis. Ife, the owner, works hard, enjoys it every day, and has proven to be one of the toughest women I have ever met. During my time there I learned that it is not what you do rather how you do something that makes it meaningful. The role of the ethnographic method is central in allowing me to study a sub-culture of society, one often out of the public eye, through participant observation and casual conversation. Through participant observation, I was able to interact with customers as the part-time cashier and help Ifa with minute tasks. The ethnographic method was especially useful when using my senses to identify patterns and themes of the store's rhythm. In doing so, I discovered a consumerist world enveloped by trust, compassion, love, care, and grit by its owner. Her interactions with customers is soft yet stern, and her ability to keep the store afloat is very much tied to the respect and trust she gives and receives. Through this ethnography I both validate the value of the ethnographic method and demonstrate one woman's use of empathy and love to recognize the humanity in her customers. Ife mirrors what we all should practice everyday; selfless benevolence.

Interdisciplinary Topics
4:15-5:00 pm
Clough 417

4:15-4:30 pm *A look at the shifting standards model as an individual difference in a financial aid allowance task*
Nicholas Pappas
Faculty Sponsor: Matthew Weeks, Department of Psychology
The shifting standards model proposes that descriptions of others are made in reference to some standard of judgment. These standards of judgments are often represented as stereotypes about groups, such as the beliefs that men are taller than women or Asian students are better at math then White students. Previous research has demonstrated a shifting standards effect in regard to race and socioeconomic status (SES). The current study uses the shifting standards effect as an individual difference in a financial aid allowance task to predict how much financial aid a Black target should receive. We predict that those who show a stronger shift in the stereotypical direction of the Race x SES shifting standards task will judge a family's income to be better than those who show a weaker shift, and thus will give out less financial aid to the high-status black target in the financial aid allowance task.

4:30-4:45 pm *Mammy and the Housewife: Feminine Expressions of Racial Superiority in American Film and Advertisement Media During the Great Depression*
Chandler Hall
Faculty Sponsor: Charles Hughes, Department of Urban Studies & Africana Studies

Many scholars have examined the mammy's role in the white mind, including the circumstances surrounding her invention and the purpose of her existence. However, analyzing the juxtaposition of the white woman with the mammy is also central to understanding the evolving ideas of middle-class femininity and white expectations for black behavior during the Great Depression. I argue that in the 1930s, the decline of domestic servitude and simultaneous transformation of the white housewife are responsible for the resurgence of the mammy figure in popular culture. I examine film and advertisement media because of their mass market accessibility, their attempt to persuade, and the national attention and acclaim that they often received. Pairings of the mammy with figures of white women illustrated white perceptions of female sexuality, delineated the role of women in society, and defined a new "true womanhood."

4:45-5:00 pm *Affirming the Inclusion of Diversity Programs: The (d)Evolution of Affirmative Action Since Bakke*
Timothy Nelson
African Americans have been the poster children of affirmative action since its proposal by President Lyndon B. Johnson at Howard University in 1965. However, those who have mainly benefitted from affirmative action programs over time does not match this common narrative and understanding who has benefitted from affirmative action not only highlights the present-day need for affirmative action, but also highlights how it never even remotely achieved what it was initially proposed to have done. Affirmative action was proposed to be for poor African Americans, but the main beneficiaries of affirmative action is continually demonstrated to be white women, as is confirmed in this study that observed EEOC data from the past twenty years. To help explain this phenomenon, alongside the decrease in usage of affirmative action and its intrinsic racialized component on contemporary dialogue, I show how affirmative action has become more racialized since the Bakke decision and how this has conversely led to a decrease in positive coverage it.

FINE ARTS ORAL SESSIONS

Digital Art Showcase
12:30-2:00 pm
Clough 302, Barret Library basement, Bryan Campus Life Center
Moderator: Karl Erikson

Digital Art Showcase
Jamie Payne, Elise Rawlinson, Livvy Rowe, Emily Burkhead
Faculty Sponsor: Karl Erickson
Students from Intermediate Digital Art Projects will present video artworks that engage in a diverse range of styles and content exploring how projected light and sound transforms the role of spector in order to create engaging experiences.

Cauthen Competition
1:30-2:30 pm
Tuthill Performance Hall
Moderator: Evan Williams

The Cauthen Competition: Final Round
Faculty Sponsor: Evan Williams
Gladys Cauthen was one of the founding influences in the development of the Rhodes College Department of Music, which grew out of the Memphis College of Music. In her honor and memory, Gladys Cauthen's legacy is remembered through the naming of this solo competition. The winner will perform with the Rhodes College Orchestra in the following academic year.

National Association of Teachers of Singing
2:30-3:30 pm
Tuthill Performance Hall
Moderator: Carole Blankenship, Department of Music

Concert of NATS Student Competitors ◙
Haleigh Boykin, Cameron Crawford, Carley Jo Goggans, Emily Haas, Abigail Sweeney, Jake Thomas, Grace Tomeny, Rachel Ward, Kathleen Whatley, Camila Zimmerman
Faculty Sponsors: Carole Blankenship and Dr. Tom Bryant, Department of Music
Each year, the National Association of Teachers of Singing sponsors vocal competitions throughout the nation. Rhodes voice students participate annually in such competitions in the Mid-South Region of NATS, the district that encompasses schools and voice studios in Kentucky and Tennessee. This April, twelve students from Rhodes traveled to Austin Peay State University to participate in the competition with the opportunity to advance to the national semi-final level. The students competed in both classical and music theatre auditions. For the Rhodes Symposium, each student who competed will sing one of the pieces they submitted and performed for this competition.

Art History Oral Presentations
2:00-3:20 pm
Hassell Hall 100
Moderator: Vanessa Rogers

2:00-2:20 pm *Living in a Museum: Enduring Aristocratic Responsibility in Arts Patronage and Conservation*
Chandler Hall

◙ Rhodes Fellowship

Faculty Sponsor: Vanessa Rogers
Although British peerages no longer carry the immense political and economic influence that they once did, some aristocratic families today still possess the cultural and artistic artifacts of their progenitors. Certain families may believe that they have a continuing social responsibility to preserve and maintain the relics of their past for modern public display. In doing so, historical homes serve as museums, and personal heirlooms function as art. I will examine the ways in which Boughton House, the largest English residence for the Duke of Buccleuch, functions as a museum, concert hall, and archive. In effect, the house is anything but a home.

2:20-2:40 pm *Walled City Music Festival Fellowship* ◙
Harley Chapman, Sabrina Hu; Tom Bryant; Vanessa Rogers, Department of Art & Art History
The Walled City Festival Fellowship is a domestic/abroad project that incorporates social, musical, historical, and professional opportunities to learn from those at the top of their fields in music. Held in Derry, Northern Ireland, I attended the annual Walled City Festival, which hosts and attracts exemplary musicians from around the world. After the completion of the festival, I explored the historical parallels of the civil conflict of the 1960s in Derry to the Civil Rights movement that transpired during the same time in the United States. This fellowship awarded me an extremely unique chance to both compare parallel social and political movements that occurred in different parts of the world, and to experience an international sense of artistry and musicianship. From this program I achieved great deal of personal growth, and now have the opportunity to share these insights with the greater Rhodes community which include ideals of social awareness, creative collaboration, and working towards a greater purpose.

2:40-3:00 pm *Dynamic Viewpoint: Element of Time in Donatello's Sculptures*
Yanxin Li
Faculty Sponsor: Victor Coonin, Department of Art & Art History
In this presentation, the seven students who traveled to Louisville, Kentucky for the College Days weekend of the Humana Festival of New American Plays on a special research fellowship over the weekend of March 22 - 24th will share their insights into the current state of the contemporary USAmerican regional theatre industry and specifically, the realm of new play development. This festival is one of the flagship new play festivals in the country and has been going strong for 43 years. Four new plays and one collectively-devised performance piece premiere in a month-long run at the Actor's Theatre of Louisville that draws theatre professionals from across the country. Literary Managers and Artistic Directors of equity companies nationwide attend this festival to see these new and edgy works and consider them for presentation. The weekend we attend is specifically programmed to help college understand the current state of the field: its histories and trends, successes and problems. Workshops, panel discussions, and keynote speeches round out the weekend of professional theatre, as well as

◙ Rhodes Fellowship

countless valuable unofficial conversations with peers and professionals alike. In this presentation, each attendee will discuss what particular part of this research weekend related to their own scholarship and career goals, and we will share with the audience how this new knowledge will help us shape their career plans.

3:00-3:20 pm *Iphigenia in Aulis: How character portrayals change from Euripides to Gluck* ◙
Camila Zimmerman
Faculty Sponsor: Vanessa Rogers
As is the case with many myths, the myth of Iphigenia at Aulis appears in many different texts and contexts, each with its own slight variation. The main reason why there are differences is because each author viewed different things as important to their society. Christoph Willibald Gluck's Iphigenie en Aulide (1774), which is based on Euripides' telling of Iphigenia in Aulis is an example of such differences. Many forms of music, especially early operas, have drawn inspiration from ancient myths and history, showing that the stories of the past continue to have meaning and significance throughout time. Euripides and Gluck's works are based on the story of the sacrifice of Iphigenia, but each was written in a different period. Because of these time differences, each telling has variations in plot as well as in the emotion and characteristics of the characters. Since Iphigenia is the main character in each story, one would expect her to say the most and appear the most often; however, the way Iphigenia is portrayed parallels the view of the author and the author's society on women and their roles. I will compare and contrast the Iphigenia's from both Gluck and Euripides' works by looking at the text itself, imagery from both time periods, and historical background and context of the time in which it was performed to shed light on how these differences in society are reflected in the character portrayals themselves.

Theater Sessions
3:30-4:30 pm
McCoy Theatre
Moderator: Joy Fairfield

3:30-4:00 pm *Humana Festival of New American Plays Research Fellowship* ◙
B Lever, AnDrea Hargrove, Bella D'Aprile, Tallulah Schley-Ritchey, Valentino Harris, Kaylan Freeman, Thea Li
Faculty Sponsor: Joy Fairfield, Department of Theatre
In this presentation, the seven students who traveled to Louisville, Kentucky for the College Days weekend of the Humana Festival of New American Plays on a special research fellowship over the weekend of March 22 - 24th will share their insights into the current state of the contemporary US American regional theatre industry and specifically, the realm of new play development. This festival is one of the flagship new play festivals in the country and has been

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going strong for 43 years. Four new plays and one collectively-devised performance piece premiere in a month-long run at the Actor's Theatre of Louisville that draws theatre professionals from across the country. Literary Managers and Artistic Directors of equity companies nationwide attend this festival to see these new and edgy works and consider them for presentation. The weekend we attend is specifically programmed to help college understand the current state of the field: its histories and trends, successes and problems. Workshops, panel discussions, and keynote speeches round out the weekend of professional theatre, as well as countless valuable unofficial conversations with peers and professionals alike. In this presentation, each attendee will discuss what particular part of this research weekend related to their own scholarship and career goals, and we will share with the audience how this new knowledge will help us shape their career plans.

4:00-4:30 pm *Screenplay Intensive Spring 2019*
Lydia Podowitz
Faculty Sponsor: Joy Fairfield, Department of Theatre
This presentation consists of a staged reading of an original feature-length screenplay I wrote for a directed inquiry. The story is a comedy about a teenage girl, in high school, who gets gum stuck in her hair and as a result, gets a short haircut that makes her look like a boy. All of a sudden, everyone at her high school thinks she's a lesbian. She decides to roll with it. With this project, I am hoping to explore the societal pressure on individuals to conform to prescribed identities and the stereotypes associated therein. Through this story, I also hope to critique the trending narrative of Queerness as something to be appropriated and made "cool" by hyper-liberal circles that tend to utilize advocacy for their own political benefit or social standing.

SCIENCE ORAL SESSIONS

Honors Chemistry Research
1:30-2:30 pm
Robertson 110
Moderator: Mary Neil Hodl

1:30-2:00 pm *Computational analysis and synthesis of potential inhibitors active against Gram negative bacteria*
Rebeca Roldan; Mauricio Cafiero and Larryn Peterson, Department of Chemistry
Faculty Sponsor: Larryn Peterson, Department of Chemistry
LpxC, an enzyme involved in the first committed step of the biosynthesis of lipid A, has been found to be a potential drug target and the inhibition of LpxC is crucial to developing novel antibacterial agents. Based on key information found from the study of the crystal structure of LpxC, novel inhibitors have been designed with the natural substrate of LpxC in mind. Previous

inhibitor design included a nucleoside, however based on extensive analysis of those ligands the current focus has been placed on small, non-nucleoside containing compounds. Proposed inhibitors have been studied computationally through analysis of the ligands bound in the active site of LpxC. A special emphasis has been made on the use of 1,2,3-triazoles as a key component of the proposed analogues, due to key interactions between the zinc ion and the triazole group, the versatility of azides and ease of synthesis through the use of "click chemistry" methods. Computational binding studies of a sweep of proposed 1,2,3-triazole ligands have been completed in order to focus synthesis on the best performing triazole-containing ligands. The analysis of these analogues as well as the different synthetic pathways used to synthesize these compounds will be discussed.

2:30-3:00 pm *Survey of quantum chemical methods for computing interaction energies in organometallic systems* ◙

Rebecca Evans; Larryn Peterson, Department of Chemistry
Faculty Sponsor: Mauricio Cafiero, Department of Chemistry

The local, GGA, meta-GGA, and hybrid functionals were used to evaluate the structure and interaction energies of novel ligands in the TyrOH active site. TyrOH is the rate determining enzyme in the catecholamine-dopamine pathway, converting tyrosine to L-DOPA. The inhibition of TyrOH, however, reduces dopamine in the brain to undetectable levels (Spector et al., 1965). A crystal structure of the active site of tyrosine hydroxylase with a known inhibitor bound was obtained from the protein data bank (PDB ID: 2TOH) (Goodwill et al., 1998). In this work, dopaminergic derivatives, which could be potential treatments for Parkinson's disease, were inserted into the enzymatic active site in silico in order to test the strength of the interactions between the ligand and active site, to determine if any of these derivatives could be effective inhibitors. Various local, GGA, meta-GGA, hybrid, and double-hybrid dispersion functionals were used to optimize structures and to analyze interaction energies. The novel dopaminergic derivatives were optimized in the active site with implicit solvent with all of the above functional types and 6- 31G with relaxed amino acid side chains. Counterpoise-corrected interaction energies between the ligands and protein were determined using the same DFT methods mentioned above with the 6-311+G* basis set. This work shows significant differences between the methods within the same complex. The analysis has also helped to determine promising ligands for the treatment of Parkinson's disease that would not inhibit TyrOH.

The Natural World

Frazier-Jelke D
1:30-2:15 pm
Moderator: Kristin Reed

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1:30-1:45 pm *Converting Pediatric and Young Adult Patients from a Shunt to a Third Ventriculostomy: A Multicenter Experience* ◙

Pooja Dave; Matthew Weeks, Department of Psychology; David Hersh and Paul Klimo Jr., University of Tennessee Health Science Center; Brandy Vaughn, Le Bonheur Children's Hospital; Todd Hankinson and Susan Staulcup, University of Colorado Anschutz Medical Campus; Brandon Karimian, Mark Van Poppel, Scott Wait, Carolina Neurosurgery and Spine Associates

Faculty Sponsor: David Kabelik, Department of Biology

Background: Endoscopic third ventriculostomy (ETV) is an effective first-line alternative to shunting in children with certain forms of hydrocephalus. However, ETV in patients with an existing shunt may be underutilized and underreported. Objective: To report a multicenter experience in attempting to convert patients from shunt dependence to a third ventriculostomy, and to determine predictors of success. Methods: Three participating centers provided retrospectively collected information on patients with an attempted conversion from a shunt to an ETV between December 1, 2008 and April 1, 2018. Demographic, clinical, and radiological data were recorded. Success was defined as shunt-independence at the last follow-up. Results: A total of 80 patients with an existing ventricular shunt underwent an ETV. The median age at the time of the index ETV was 9.9 years and 44 (55%) patients were male. The overall success rate was 64% (51/80), with a median duration of follow-up of 2.04 years (range, 0.08–9.40 years). Four patients required a repeat ETV following failure of the index ETV but did not require replacement or revision of their ventricular shunt. Revision ETVs occurred at a median of 1.66 years (range, 0.09–5.74 years) following the index ETV. Only age was predictive of ETV failure on multivariate analysis (OR, 0.86; P=0.005). Conclusion: While not every shunted patient will be a candidate for an ETV, nor will they be successfully converted from their shunt, an ETV should at least be considered in every child who presents with a shunt malfunction or who has an externalized shunt.

1:45-2:00 pm *Mechanism and patterns of expression of manganese transporters involved in resistance of Salmonella Typhimurium to nitric oxide stress*

Shehla Yousuf; Elaine Frawley, Department of Biology

Faculty Sponsor: Elaine Frawley, Department of Biology

Nitric oxide (NO.) is a radical molecule that is produced by the mammalian host immune system in response to pathogenic bacteria like Salmonella Typhimurium,but many of its cellular targets remain unknown. Microarray data showed that manganese transporters mntH and sitABCD are among the most highly upregulated genes in response to NO.. Expression of these transporters in response to NO. stress, along with a third (zupT), was validated using qPCR. Corresponding changes in intracellular manganese levels were monitored using inductively coupled plasma mass spectrometry (ICP-MS). Manganese levels initially rise in response to NO. before returning to baseline levels within 60 minutes, a pattern repeated in the transporter expression levels.

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Increases in transporter expression and total manganese suggest that manganese may play a role in allowing bacteria to resist NO. stress. Transporter mutants are more sensitive to NO. while complementation studies show that expression of only one transporter is sufficient for protection. Transporter expression appears to be tightly regulated during the stress response, though the mechanism is largely unknown. Three regulatory proteins, OxyR, MntR, and Fur, have been predicted to play a role in regulating mntH and sitABCD. ΔoxyR, ΔmntR, and Δfur mutants were created and expression of mntH, sitABCD, and zupT were measured by qPCR in the presence and absence of NO. to determine how regulation occurs under these conditions.

2:00-2:15 pm *The Hof1 protein of Aspergillus nidulans is necessary for cytokinesis*
Lauren Rowland; Loretta Jackson-Hayes, Department of Chemistry
Faculty Sponsor: Terry Hill, Department of Biology
Cytokinesis is an essential component of cellular development in filamentous fungi. The process requires assembly and constriction of a contractile actomyosin ring (CAR) in the cell periphery as well as the simultaneous construction of a chitin-rich cross wall termed a septum, which separates semi-independent compartments of the fungal hypha. Through randomized mutations, we generated a temperature-sensitive mutant defective in septum formation, designated strain RCH59. Mendelian crossing confirmed that the temperature sensitive phenotype results from a single locus mutation. Next Generation Whole Genome Sequencing identified a mutation that is located in gene AN4963 encoding the homolog of Saccharomyces cerevisiae's hof1. The mutation in Aspergillus nidulans' version of hof1 (Anhof1) is at base 2436 out of 3536 and is a transition from cytosine to thymine. The mutation is predicted to remove an arginine and introduce a premature stop codon after residue 738. We cloned the wildtype version of the Anhof1 gene into plasmid pRG3 and complemented the phenotype in strain RCH59, confirming that the mutation occurs in Anhof1. We also deleted the Anhof1 gene to demonstrate that an Anhof1 minus strain has an aseptate phenotype. In the yeasts, S. cerevisiae and S. pombe, the Hof1 protein forms a ring structure that co-localizes with the CAR and is involved with mediating the cytoskeletal rearrangements necessary for cytokinesis. In both RCH59 and the Anhof1 deletion strains, the CAR was able to form and localize at potential septation sites, but was unable to constrict. Currently, we are conducting co-immunoprecipitations to identify binding partners of AnHof1.

The Physical World
1:30-2:15 pm
Frazier-Jelke C
Moderator: Aubrey Gray

1:30-1:45 pm *Ultrasonic bone assessment using backscatter measurements at 1 MHz*
Evan Main, Phoebe Sharp; Brent Hoffmeister, Department of Physics

Faculty Sponsor: Brent Hoffmeister, Department of Physics

There is interest in developing ultrasonic techniques that can be used to detect changes in bone caused by osteoporosis. One approach, called the backscatter difference technique, measures the power difference between two portions of a backscatter signal from the porous tissue inside the bone, called cancellous bone. The present study uses a 1 MHz transducer which may improve performance at central skeletal sites such as the hip and spine. Measurements were performed in vitro on 54 cube shaped specimens of cancellous bone from 14 human femurs using a 1 MHz transducer. Received backscatter signals were analyzed to determine the normalized mean of the backscatter difference (nMBD) which was computed by measuring the power difference between two gated portions of the backscatter signal in decibels and dividing by the gate separation in microseconds. Linear regression analysis found weak to moderate correlations ($0.13 \leqq R \leqq 0.66$) between nMBD and bone density, depending on which portions of the signals were analyzed. These results suggest that backscatter difference measurements using a 1 MHz transducer may be able to detect changes in bone caused by osteoporosis

1:45-2:00 pm *MagiDiscs: Magically-Coded Puzzle Discs*

Sadler Bullard, Alfonso Canady, Tanner McDaniel

Faculty Sponsor: Betsy Sanders, Department of Mathematics and Computer Science

MagiDiscs is an interactive 3-dimensional virtual reality (VR) puzzle game made with Unity for the HTC Vive VR system. In it, the player uses the Vive's HMD to view the environment and the controllers to interact with menus and objects. The goal for the player is to complete a series of disc puzzles that increase in complexity. Each disc has a 9x9 grid of tiles which the player can interact with, and four input nodes around the edge of the grid. The centermost tile is the output tile and cannot be changed. The player is limited by how many discs they may use for a puzzle, which tiles they can change, and what functions are available to them. Two function tiles are a switch that allows an input to pass through if the switch is powered or unpowered, and a conditional function that outputs a neutral signal of 0 or 1 when a condition is true. Special crystal tiles can reference discs stored in memory without needing to be adjacent to that disc. By placing and editing functions in specialized tiles and by controlling the direction of element-based signals between tiles, the player creates basic code structures. These code structures are the puzzles, and the success of each puzzle is determined by the output of a disc or series of discs.

2:00-2:15 pm *Comparison of backscatter difference measurements of bone using an ultrasonic imaging system to stiffness index measurements of bone using a heel bone sonometer*

Loukas Georgiou, Doni Thomas, Evan Main, Gia Pirro, Will Newman, Aubrey Gray; Brent Hoffmeister, Department of Physics

Faculty Sponsor: Brent Hoffmeister, Department of Physics

Ultrasonic devices called heel bone sonometers are used to screen patients for osteoporosis. The devices measure the speed and attenuation of ultrasonic pulses propagated through the heel bone

(calcaneus) to determine a quantity called the stiffness index (SI). Our lab is developing ultrasonic techniques that can be used at the hip and spine, locations where approximately 2/3 of osteoporotic fractures occur. In this study, we measured an ultrasonic parameter called the normalized mean of the backscatter difference (nMBD) using an ultrasonic imaging system. nMBD measures the power difference between two different portions of a backscatter signal received from the bone. Ultrasonic measurements were performed at multiple skeletal locations on 12 volunteers. nMBD was measured at the L4 vertebral body, left and right femoral necks, and left and right calcanei. SI was measured at the left and right heels. Linear regression analysis was used to examine correlations between nMBD and SI at different skeletal locations. The strongest correlation (R = 0.51) was found between nMBD and SI measured at the left heel. The lowest correlation was (R=0.08) was found between nMBD measured at the L4 vertebral body and SI measured at the right heel.

Novel Apps I
1:30-2:15 pm
Frazier-Jelke A
Moderator: Austin Barringer

1:30-1:45 pm *MealShare*
William Robichaux, Connor Ross, Geoffrey Adams
Faculty Sponsor: Catherine Welsh, Department of Mathematics and Computer Science
We need food everyday in order to maintain a healthy lifestyle, as it is our primary source of energy. However, we don't always have time to prepare delicious meals every day. Food isn't just an essential source of energy, it is also a carrier of an individual's culture. To help users save time and introduce themselves to new foods, we have developed a prototype we call MealShare. MealShare is a community based Android application that allows users to share meals between each other. Users can create and join meal sharing groups in which they can post and request meals. This process allows people to save time by not having to cook every night of the week, try new foods cooked by other people, and potentially save money by cooking in bulk and receiving meal credits.

1:45-2:00 pm *River App*
Michael Pabst, Brannin Webber, Jimmy Schermer
Faculty Sponsor: Catherine Welsh, Department of Mathematics and Computer Science
River is a desktop application that allows users to create custom playlists with their favorite Netflix shows. Episodes are then shuffled together to make a random playlist of continuous content with no user interaction. The use for our app is to create an almost cable TV like viewing experience with users online streaming services. By gathering data from Netflix through their URLs and the HTML code, our team was able to obtain every showID and other useful

information for the entire Netflix catalog. We are able to organize the information in a way not available anywhere else on the Internet and direct a web browser to a specific Netflix episode. This allows us to create custom playlists and store the information for continuous playback. The goal of our app is to create a simpler viewing experience for users of online streaming services.

2:00-2:15 pm *MapShare*
Will Clinton, William Fu, David Bultena
Faculty Sponsor: Catherine Welsh, Department of Mathematics and Computer Science
MapShare is an Android mobile application that utilizes location based services for the dual purposes of education and fun. The main feature of the application is the ability for a user to create and share maps with whomever they desire. The uses are endless: A travel-blogger creating maps that feature their favorite destinations across the country, a local teacher creating a map with historical sights around Memphis for their students, or you creating a map of your favorite local restaurants for your friend who is visiting the area. A key feature that differentiates our application is the ability for users to add content, including photos and videos, that are tied to each location on the map. Map followers will only be able to view the full content of a marker when they are nearby, encouraging users to explore the world around them. We will be discussing details of the implementation, our methodology, and challenges we faced along the way.

Molecular Modeling I
2:30-3:15 pm
Robertson 110
Moderator: Rishabh Mazumder

2:30-2:45 pm *DFT study of the binding of ligands in SULT1A3 active site* ◙
Kayla Puzdrakiewicz; Larryn Peterson and Mauricio Cafiero, Department of Chemistry
Faculty Sponsor: Mauricio Cafiero, Department of Chemistry
Sulfotransferase 1A3 (SULT1A3) aids in the regulation of various endogenous and exogenous substrates in the body via sulfation. Specifically, this enzyme catalyzes the reaction that selectively sulfates dopamine and acetaminophen. In order to distinguish the selectivity of SULT1A3, the electronic interaction energies between the active site of this enzyme and a suite of molecules known to inhibit enzymes in the dopamine pathway have been calculated using M062X with the 6-311+G* basis set. The SULT1A3 active site was isolated from the crystal structure with dopamine bound (PBD ID:2A3R). Optimized structures for eleven ligands bound in the active site were obtained by M062X/6-31G with implicit solvation by water and relaxed amino acid side chains. At least one of the ligands currently studied would bind to SULT1A3

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more strongly than dopamine and some previously studied ligands (D.J. Bigler et al. / Computational and Theoretical Chemistry 1051 (2015) 79–92).

2:45-3:00 pm *Characterization of the THSD7A Antigen and Protein Engineering for the Design of Novel Therapies for Idiopathic Membranous Nephropathy*

Mounika Aramandla, Maggie Palopoli, Serena Stoddard, Riya Patel, Colin Welsh
Faculty Sponsor: Shana Stoddard

Autoimmune diseases (AD) result from the attack of healthy cells by the immune system. AD are the second leading cause of long-term chronic illness. Current therapies combatting AD, immunosuppressive medicines, are non-specific and weaken the patient's immune system, decreasing the ability to elicit a full immune response, thus putting them at higher risk of being unable to fight off basic infections. Idiopathic membranous nephropathy (IMN) is a kidney specific AD affecting 10-12 million people. One subset of patients with IMN produce autoantibodies that target the thrombospondin type-1 domain-containing 7A (THSD7A). In this work, both characterization of THSD7A and antigen specific binding proteins are being designed to prevent autoantibody binding. Epitope sites (ES) on THSD7A were predicted using Epitopia. Eighteen of the 21 domains on THSD7A were predicted to contain ES. These ES were classified into five regions (alpha, beta, gamma, delta, and epsilon). In this work, domains 5 and 7 were characterized of the THSD7A antigen. Domain 5 was shown to contain 30.30% hydrophobic residues, 34.90% polar uncharged residues, 16.30% positively charged residues, and 20.90% negatively charged residues. Data indicates that domain 7 contains 45.50% hydrophobic residues, 31.80% polar uncharged residues, 13.60% positively charged residues, and 9.10% negatively charged residues. Design of antigen specific binding proteins for domain 5 of THSD7A are currently being performed using the monobody template, 3RZW. Initial in silico mutagenesis and design of these antigen specific binding proteins will be discussed. This research could provide patients with more specific treatment routes for AD than the current immunosuppressive therapies.

3:00-3:15 pm *In silico Prediction of Immunogenic Sites on PMN Antigen and Design of Epitope Blocking Caps*

Colin Welsh, Candace A. Hayes, Xavier A. May; Shana V. Stoddard, Department of Chemistry
Faculty Sponsor: Shana Stoddard, Department of Chemistry

Autoimmune disorders (AD) are a type of disease in which an individual's immune system attacks the cells of its own body. Currently, AD are the 2nd leading cause of chronic long term illness. The primary method of treating AD is the use of non-specific immunosuppressant drugs, suppressing the entire immune system and leaving the patient vulnerable to infections. Antigen specific therapies have been proposed in order to replace treatment with immunosuppressant drugs for AD. The work here focuses on developing a new approach to AD therapy which targets

the epitope site (ES) on the antigen, with an emphasis on the kidney specific AD primary membranous nephropathy, which affects 10-12 million people worldwide. Using in silico mutagenesis the ES on the phospholipase A2 receptor (PLA2R) were predicted and epitope binding proteins (EBP) were developed to target these regions. Using Epitopia and EPCES two regions on the CTLD1 domain of PLA2R were identified as potential ES. These ES are characterized in terms of the number of residues, their electrostatic potential, and their hydrophobicity. In silico prediction of immunogenicity showed the single nucleotide polymorphisms M292V, H300D, and G1106S do not directly contribute to immunogenic sites on PLA2R. In silico mutagenesis of two protein templates (5IMK and 4JE4) was performed to design EBP structures. The Rosetta protein-protein docking server was used to evaluate the interface score of designed EBP to the PLA2R antigen, and disruption of binding to their original binding partner via molecular mechanics calculations. In silico mutations to the 5IMK monobody increased the binding interface score from -4.259 rosetta energy units (REU) to -8.903 REU. Similarly, in silico mutations to the 4JE4 monobdy increased the interface score from -3.964 REU to -5.867 REU. Data shows the introduction of charged residues to the monobody contributes to the most significant gains in interface score. Further in silico mutations were introduced to disrupt the binding preference of 5IMK and 4JE4 to their original targets. Binding potency was reduced from -7.851 REU to -3.87 REU for 5IMK, and from -12.263 REU to -3.693 REU for 4JE4. This work could be used to develop a new antigen specific therapy approach for PMN and AD in general.

Computational Modeling
2:30-3:00 pm
Frazier-Jelke D
Moderator: Gia Pirro

2:30-2:45 pm *Computational methods for reconstructing galaxies' velocity fields* ◙
Duc Hoang
Faculty Sponsor: David Rupke, Department of Physics
Understanding galactic rotations of galaxies is essential to the study of galaxy evolution. However, the usual data obtained from redshifts of distant galaxies only gives us information about the velocities along the line-of-sight, which is the direction that we observe it. Thus, being able to interpolate from these data other parameters about the structure of the galaxies will, without much efforts to obtain other complex data sets, significantly improve our understanding of the galaxies. I obtained an accurate fit for rotation curves of the galaxy, reconstructed the galaxies' velocity fields of the galaxy based on a model of concentric ellipses. Different software has also been tested towards these goals, including Tirific and KINEMETRY IDL library. As Tirific is proven to be too complex to be efficiently utilized, KINEMETRY has been used to automatically fit the rotation curves and other important dynamical parameters of PG-1411

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Galaxy. Furthermore, KINEMETRY shows its potential to automatically construct the whole velocity field from simple inputs of the galaxy's velocity's data, and thus is a very promising tool to model the galaxies' kinematical structure.

2:45-3:00 pm *Mixed Feelings: Natural Language Generation with Variable, Coexistent Affective Categories*
Lee Kezar
Faculty Sponsor: Phillip Kirlin, Department of Mathematics and Computer Science
Conversational agents, having the goal of natural language generation, must rely on language models which can integrate emotion into their responses. Recent projects outline models which can produce emotional sentences, but unlike human language, they tend to be restricted to one affective category out of a few (e.g. Zhao et al. (2018)). To my knowledge, none allow for the intentional coexistence of multiple emotions on the word or sentence level. Building on prior research which allows for variation in the intensity of a singular emotion (Ghosh et al., 2017), this research proposal outlines an LSTM (Long Short-Term Memory) language model which allows for variation in multiple emotions simultaneously.

Virtual World I
2:30-3:15 pm
Frazier-Jelke C
Moderator: Loukas Georgiou

2:30-2:45 pm *Simulating Microaggressions in Virtual Reality*
Brennan Newton, Clare Edgar, Mary Bolton
Faculty Sponsor: Betsy Sanders, Department of Mathematics and Computer Science
Queer people are often subject to the negative effects of bias, which can present itself in the form of microaggressions. Microaggressions are everyday slights directed towards outgroup members, and prior research shows that these slights have a negative impact on the wellbeing and growth of LGBT people. Other research has used virtual reality (VR) as an effective tool for reducing implicit bias in users when embodying human characters that look different from their own bodies. This study aims to see if VR is an effective tool for eliciting emotional responses to microaggressions by having participants embody someone who experiences these slights. To simulate this, we surveyed 21 members of the LGBT community for instances of microaggressions they have experienced, and we incorporated four of these into virtual simulation. This project aims to study users as they move through a campus virtual environment seen through a head mounted display (HMD) and experience a series of microaggressions. Heart rates of the participants are tracked throughout the experiment, and then participants are surveyed about their experience. This research has implications for embodiment in VR, methods to reduce microaggressions, inclusivity, and safe ways to elicit sympathy.

2:45-3:00 pm *Virtual Counselor: Emulating Microskills of Psychotherapy*
Lee Kezar, Jillian Gamble
Faculty Sponsor: Betsy Sanders, Department of Mathematics and Computer Science
Mental illnesses afflict approximately 20% of Americans, but access to mental health care is not accessible to most people, either due to distance, cost, or mental health stigma. As research in computer science advances (specifically in the subdomain of natural language processing), the ability for computers to contribute to mental health outcomes becomes more feasible. In this senior thesis project, we design and implement an application which engages the user in a natural, spoken conversation, emphasizing the use of "microskills" that are common among psychological counselors. Some examples of these microskills include attending behaviors (e.g. encouraging, paraphrasing, summarizing) or dealing with emotions (e.g. evoking and reflecting emotions). The model achieves this goal by cyclically understanding and processing human speech and then generating a response. The understanding and processing steps entail parsing the grammatical structure, estimating personality and affective state, and selecting an appropriate microskill based on semantic features of the conversation. Finally, the generation step produces a response which emulates the selected microskill. Participants were recruited to rate the model's efficacy in terms of naturalness and psychometric measures such as affective state.

3:00-3:15 pm *Donation News: A Natural Disaster Relief Application*
Eric Hein, Sahil Reddy, Michael Bardos, Shane Kelley
Faculty Sponsor: Betsy Sanders, Department of Mathematics and Computer Science
With the growing threat of natural disasters due to man-made climate change, we have created an application that allows everyday people to provide relief for such disasters. This is accomplished by updating users whenever large-scale natural disasters occur. With these updates, users are able to donate a small sum of money – ideally for amounts as small as 5¢ so anyone can contribute – of their choosing to help those affected by the linked natural disaster. The developers provide a charity for the disaster based off research, linking users to charities relevant to the specific disaster and that allocate their funds in a trustworthy and effective manner. Users are notified of disasters from established news sources, like ABC News and the Associated Press. For example, if this application was made during the California Wildfires, the users would have gotten an update on the situation in California and surrounding areas and been given the option to donate a small sum to help those who have been killed, hurt or displaced by the wildfires. Other donation applications either do not supply relevant news articles or do not focus on natural disasters, instead focusing on themes for the day or month (ex: breast cancer awareness month).

<u>Medicinal Science I</u>
2:30-3:15 pm

Frazier-Jelke A
Moderator: Zach Cornelison

2:30-2:45 pm *MitoMut: an efficient approach to detecting mitochondrial DNA deletions from paired-end next-generation sequencing data* ◙
C. Shane Elder; Catherine Welsh, Department of Mathematics and Computer Science
Faculty Sponsor: Catherine Welsh, Department of Mathematics and Computer Science
Next-generation sequencing data necessitates the use of bioinformatic pipelines to detect mitochondrial DNA (mtDNA) deletions. Many computational methods exist to quantify the existence of nuclear deletions; however, factors such as copy number and mutation rate render these tools ineffective on mtDNA. Recently, other tools have been developed to detect mtDNA deletions, but they require large amounts of RAM and have high runtimes. For a scientist without access to high-compute clusters, these barriers could prove insurmountable. We present MitoMut, a tool capable of effectively and efficiently detecting mtDNA deletions. We tested MitoMut on real-world and simulated data, showing its ability to detect deletions at very low heteroplasmy (< 1%) with high success. MitoMut consistently outperforms alternate approaches in both time and space efficiency.

2:45-3:00 pm *Investigation of Immune Infiltration Properties of Pediatric Cancer*
Andrew Frantz
Faculty Sponsor: Catherine Welsh, Department of Mathematics and Computer Science
For the study and treatment of solid tumors, it is important to understand how the patient's immune system interacts with the tumor. Immune cells infiltrate tumors to varying degrees depending on a variety of factors, some of which are not yet known. This tumor infiltration can have a large impact on patient outcome, especially with the treatment of immunotherapy. Here I present an app which runs on St. Jude Cloud that plots where a given sample lands on the global distribution of tumor infiltration of St. Jude's pediatric dataset. This allows researchers to compare their sample to the rest of the pediatric cancer landscape.

3:00-3:15 pm *Comparison between Genomic Feature Counters* ◙
Andrew Frantz
Faculty Sponsor: Catherine Welsh, Department of Mathematics and Computer Science
Feature counting is a vital step for many genomic analyses; it informs researchers how commonly a feature (often a gene) is being expressed within a given sample. This information has many applications for anyone working with genomic data, but I was primarily focused on its application to cancer research. There are a few software packages available for feature counting, all with pros and cons. The feature counter used at St. Jude is HTSeq-count because its results are very well trusted, but it is slow and expensive to run on the cloud. One of the newest feature counters is Salmon, which is by far the fastest and cheapest to run on the cloud. I was interested

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in finding out if the results from Salmon are trustworthy and if it was a suitable replacement for HTSeq-count. The two feature counters produce radically different results for most genes. Surprisingly, despite this difference they produce similar results for the genes which are most important for downstream analysis, making Salmon a viable alternative if time and money are priorities.

Modeling and Catalysis I
3:45-4:45 pm
Robertson 110
Moderator: Aryan Galani

3:45-4:00 pm *Synthesis of C6 Substituted L-Dopa Analogs*
Rishabh Mazumder, Erykah Starr; Mauricio Cafiero, Department of Chemistry
Faculty Sponsor: Larryn Peterson, Department of Chemistry
Parkinson's Disease (PD) is characterized by the loss of dopamine production in the Substantia Nigra of the brain, which results in the inability to initiate body movements. For nearly four decades, Levodopa (L-Dopa) has been a key treatment for PD. L-Dopa is the naturally synthesized precursor to dopamine and is currently the preferred treatment for PD. Since it not as polar as dopamine, it can cross the blood brain barrier and enter the brain. Once L-dopa enters the brain, it is quickly taken up and converted to dopamine via DOPA decarboxylase. Even though researchers have focused on development of L-Dopa as PD treatment, these catecholamines and their precursors can also have promising roles in other neurological pathways, as substrates and inhibitors. In conjunction with computational modeling, the current study focuses on synthesis of L-dopa analogues that can further our understanding of how these small molecules interact with their active sites in the brain and periphery.
4:00-4:15 pm *DFT Study of the Selectivity of DOPA-decarboxylase* ◙
Peyton Antwine; Larryn Peterson and Mauricio Cafiero, Department of Chemistry
Faculty Sponsor: Mauricio Cafiero, Department of Chemistry
L-DOPA is commonly used as a xenobiotic for patients with conditions such as Parkinson's disease. Clinically-administered L-DOPA is transformed into dopamine by the enzyme DOPA-decarboxylase. In order to be pharmacologically effective, L-DOPA must not be metabolized before it crosses the blood-brain barrier. Premature metabolism of L-DOPA can be prevented by inhibiting DOPA-decarboxylase in the periphery. By selectively designing an inhibitor for the DOPA-decarboxylase enzyme, a larger amount of peripheral L-DOPA can cross the blood-brain barrier. A suite of dopaminergic derivatives have been developed as potential inhibitors of the DOPA-decarboxylase enzyme. The inhibitory effectiveness of each dopaminergic derivative has been measured via in silico models in which the strength of interaction between each substrate and the enzymatic active site was analyzed. A crystal-structure of the DOPA-decarboxylase active site, docked with a known DOPA-decarboxylase inhibitor, Carbidopa, was isolated from

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the Protein Data Bank (PDB ID: 1JS3). The positions of novel dopaminergic derivatives were optimized in the active site using M062X/6-31G with implicit solvation and with flexible amino acid side-chains. Interaction energies between the ligands and the protein were calculated using M062X with the 6- 311+G* basis set. At present, a number of alternative competitive inhibitors of the DOPA-decarboxylase enzyme are being studied. Of the several different families of potential inhibitors being studied in our lab, several promise to be effective.

4:15-4:30 pm *Design of Novel Inhibitors for the Aldehyde Dehydrogenases* ◙
Caroline Magee; Larryn Peterson and Mauricio Cafiero, Department of Chemistry
Faculty Sponsor: Mauricio Cafiero, Department of Chemistry
L-DOPA is commonly used as a xenobiotic for patients with conditions such as Parkinson's disease. L-DOPA is transformed into dopamine by DOPA-decarboxylase. Dopamine derived from L-DOPA is deactivated via metabolism by a series of enzymes including Aldehyde dehydrogenases (ALDH). The targeted inhibition of the ALDH enzyme may help to prolong the effectiveness of L-DOPA, resulting in a net increase in pharmacological efficiency. By selectively designing an inhibitor for ALDH, the effectiveness of the L-DOPA can be extended by regulating the metabolism of dopamine derived from L-DOPA. The effectiveness of a series of potential inhibitors has been measured via in silico models in which the strength of interaction between each substrate and the enzymatic active site was analyzed. A crystal-structure of the ALDH enzyme with an inhibitor bound in its active site (PDB ID: 4WP7) was used to create a model of the active site. Novel dopaminergic derivatives were optimized in the active site using M062X/6-31G with implicit solvation and with relaxed amino acid side-chains. Ligands can fit into the active site in a number of ways; this work examines single molecules orientations and double molecule orientations. Single versus double ringed ligands were also tested computationally for inhibitors of ALDH. Interaction energies between the ligands and the protein were calculated using MO62X with the 6-311+G* basis set. Some potential inhibitors show promising results such as the CM series. Mutant enzymes were also studied for their affinity for the ligands.

4:30-4:45 pm *Computing a Mechanism: Proton Coupled Electron Transfer with a Nickel Schiff Base Catalyst*
Phillips Hutchinson; William Eckenhoff, Department of Chemistry
Faculty Sponsor: William Eckenhoff, Department of Chemistry
In producing catalysts capable of proton reduction, it is important to determine likely mechanistic pathways through which the reductive processes may occur. Use of computational chemistry techniques allow for the exploration of many possible mechanistic pathways and the corresponding thermodynamic favorability of each. This study makes use of Density Functional Theory (DFT) to calculate the Gibbs free energy associated with different species that may form during the catalysis. The Gibbs energies are used to determine reduction potentials and pKas,

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which are used to benchmark possible pathways with experimental data. The molecules modeled are based off of crystal structures and have corresponding electrochemical data with which theoretical findings have been found to agree to within 0.01V.

Computational Modeling II
3:30-4:15
Frazier-Jelke D
Moderator: Duc Hoang

3:30-3:45 pm *Computation and Analysis of the Hilbert Series of Covariants for the Circle Action*
Austin Barringer
Faculty Sponsor: Christopher Seaton, Department of Mathematics and Computer Science
The Hilbert series is a power series whose coefficients count the dimensions of the graded components of a graded ring, e.g. the polynomials of a given degree. In our case, the ring is the set of polynomials covariant under the circle action. The aim of this project is to compute an expression for the Hilbert series as well as the first two Laurent coefficients. This computation gives us precise information about our group, by telling us how many covariants we have of a certain degree. We will present a formula for the Hilbert series when the weight vector is not degenerate. We will also present formulas for the first and second Laurent series coefficients, and discuss progress toward implementing an algorithm on Mathematica to compute examples and test our formulas empirically.

3:45-4:00 pm *The Representations of O(2)*
Zachary Wall
Faculty Sponsor: Christopher Seaton, Department of Mathematics and Computer Science
A representation of an algebra is a defined as a vector space over a field k along with a homomorphism. An algebra over a field k is a vector space along with an associative bilinear algebra. The lie algebra of a matrix group is the tangent space at the Identity matrix. The tangent space of a matrix group at a point p is defined as the set of initial velocity vectors of diferentiable paths through the point p. Note that the path must be a function that maps and arbitrary interval of real numbers to an element of the matrix group. The matrix group O(2) has many interesting physical characteristics. O(2) or the orthogonal group is the group of n by n matrices with determinant 1, that have real number entries. After describing the one and two dimensional representations of O(2) we will calculate the number of invariant polynomials over the representations using the Molien-Weil formula.

4:00-4:15 pm *Predicting potential recovery of the endangered long-lived epiphytic bromeliad Tillandsia utriculata: an agent-based modeling approach*

Caroline Bush, Sam Crowell, Rainer Jones
Faculty Sponsor: Erin Bodine, Department of Mathematics and Computer Science
The large, long-lived epiphytic bromeliad Tillandsia utriculata has been classified as endangered in the state of Florida where its population has been significantly diminished due to predation from the invasive Mexican weevil Metamasius callizona (colloquially called the "evil weevil"). The body of all bromeliads grow in a rosette structure with a single inflorescence typically growing from the center of the rosette. Adult female evil weevils deposit their eggs in slits they cut at the base of epiphytic bromeliads, preferentially ovipositing in the largest rosettes. Once the eggs hatch, the larva consume the core of the rosette including the meristematic tissue that will eventually produce the inflorescence. It has been observed that over the past three decades of evil weevil predation, the T. utriculata population has shifted to initiating the production of inflorescences (to commence its single attempt at sexual reproduction) at smaller rosette sizes. Importantly, the size of the rosette at induction is correlated to the number of seeds produced. We have constructed an agent-based model to simulate the population dynamics of Florida T. utriculata population over many generations where the minimum size at which an individual rosette initiates inflorescence production (called induction) is an inherited trait. We use the model to explore how predation may have shifted the genetic composition of the population with regards to timing of induction and the impact this may have on population viability.

Novel Apps II
3:30-4:15 pm
Frazier-Jelke C
Moderator: Lee Kezar

3:30-3:45 pm *Robo Rover Coding Cadet: Teaching Children Coding Through Games*
Jennah Durbin, Natalia Dobrowolski, Leah Borsari
Faculty Sponsor: Betsy Sanders, Department of Mathematics and Computer Science
Robo Rover Coding Cadet is an education entertainment game that teaches computer science concepts to children. The game takes place in a fun and colorful world filled with animal-like aliens and rainbow-colored flora and fauna. The game centers around Orbert, a rover sent into space to discover life, and the player's job is to control Orbert through typed commands that mimic real coding. Our game world consists of four "levels," or lessons, with each level in a specific area of the game world. This includes a short tutorial to introduce the user interface and command-typing system. The levels guide the player through important computer science concepts such as variables and loops. The world was created using the Unity game development engine and the models were created using Blender and Maya modeling software. There are currently two schools of thought in computer science education software. The first is to present problems that can only be solved one way using pre-defined block-based code, leaving very little room for exploration. The second is presenting an open-ended tool with the expectation that an

in-room teacher would provide the guidance and structure for the exercise. This project aims to create an open world feel, completely accessible to the player,that promotes experimentation and exploration and allows players to create unique solutions to puzzles in a way that is not offered in other teaching games.

3:45-4:00 pm *Lynx Adventure*
Rachel Fox, Emma Goff, Emily Wilson
Faculty Sponsor: Betsy Sanders, Department of Mathematics and Computer Science
Lynx Adventure provides a fun new way to explore Rhodes College campus. The app uses AR, Augmented Reality, on an iOS device to provide a tour of campus landmarks. AR, such as seen in PokémonGo and Snapchat filters, allows digital objects to appear in combination with reality via a user's mobile camera. The app is aimed to be used by the general population, ideally prospective or newly enrolled Rhodes students. Our iOS app features over a dozen locations with virtual objects and fun facts about Rhodes' campus. Users can wander to different buildings with the app open on their phone. Through the camera on the user's smartphone, the image of campus will be displayed with floating objects that the user can interact with on screen. When an image is tapped, for example, the coffee cup floating in the Middleground, the user will receive the information about our coffee distributor. This app allows us to better understand the rapidly developing field of AR while providing a service for visitors and new students.

4:00-4:15 pm *PartyTime Application*
Nick Bosma, Allante Carr, Noah Daniel
Faculty Sponsor: Betsy Sanders, Department of Mathematics and Computer Science
For many college students, money is a pressing issue. Students also attend a multitude of events such as parties, job interviews, formals and more requiring them to maintain an incredibly diverse wardrobe. These two realities create a predicament for a majority of the student population. PartyTime is an iOS based application for iPhone that seeks to resolve this issue by allowing students to rent clothes for special occasions, or to make money by loaning their own items. PartyTime lets students rent or loan their dresses, accessories, costumes, suits and more for low prices while being covered for damages by a predetermined replacement fee. PartyTime also allows users to organize groups and events both publicly and privately that contain their own rental areas. The goal of this functionality is to connect student within the Memphis community while eliminating the need for purchasing expensive and rarely used items. The app was written in Swift and created in Xcode using firebase to store data. The members of the group completely self taught these skills through youtube tutorials and a hefty amount of StackOverflow searching. The application is fully functional, however we still have not completed the legal/payment portion of launching it to the public. We hope to accomplish this soon, and release it in Memphis next spring semester.

Novel Apps III
3:30-4:15 pm
Frazier-Jelke A
Moderator: Doni Thomas

3:30-3:45 pm *Stop Phishing 2019*
Sophie Smith, Julie Charbonnet, Braith Jackson
Faculty Sponsor: Catherine Welsh, Department of Mathematics and Computer Science
Over the course of our time here at Rhodes, phishing emails have become a huge problem. We wanted to provide a service that would help in identifying these emails, so the attacks can be addressed directly. Rhodes students, faculty, and staff can forward suspicious emails to phishingresearch@rhodes.edu and receive an analysis of their emails detailing the likelihood that they are phishing. By parsing these emails and flagging suspicious URLs and keywords using a Python script, we are able to determine if an email has the potential to be malicious. Students, faculty, and staff will receive automated responses indicating whether or not any links in the email are not safe to open and if our Python script flagged the email as phishing.

3:45-4:00 pm *Building MIDI Instruments*
Marcus Tate, Negusu Hizkias
Faculty Sponsor: Catherine Welsh, Department of Mathematics and Computer Science
Many people have a passion for music, whether it's producing music or performing music. However, a large number of people are unable to express their passion for music, mainly because the cost of owning an instrument and getting lessons for that instrument is prohibitive. Therefore, we propose a solution using programming and electronics. Our project involves taking a guitar controller from the video game, Rock Band 4, and reprogramming it to become a MIDI instrument using an Arduino microprocessor.

4:00-4:15 pm *Rhodes Rooms Reservations*
Zach Cornelison, Chandler Braxton, Will McIntyre
Faculty Sponsor: Catherine Welsh, Department of Mathematics and Computer Science
There is not currently an efficient and fair system in place for reserving library rooms on campus, which makes it difficult to acquire a space for meetings, studying, or leisure. To combat this, we designed a website called "Rhodes Room Reservations". Using the website will allow individuals or groups of students to find adequate library space to do work without wasting time and energy finding a location. The website will be especially advantageous during finals week when people are constantly searching for a place to form study groups, and space in the library is extremely limited. The website will not only help people find a place to study, but it will also prevent people from reserving then hoarding study rooms in the library for extended stretches

during the entire finals week. With a reservation system in place, students will be forced to adhere to time limits and minimum room usage rules, which will allow everyone to have a fair opportunity to use the available library study rooms.

HUMANITIES ORAL SESSIONS

Rhodes Historical Review
11:00 am – 12:30 pm
Buckman 200
Moderators: Sarah Eiland and India Nikotich

11:00 am - 11:30 pm *Nazi Propaganda and German Rearmament: How Adolf Hitler and the Nazi Party Presented Re-Militarization to the German Public*
Chandler Vaught
Faculty Sponsor: Jonathan Judaken, Department of History
The First World War left Europe a shattered and bloodied continent by 1918. All of the European nations that took part in the global struggle suffered unprecedented numbers of casualties and catastrophic economic losses. Germany was blamed for the calamity by the victorious nations and therefore severally punished under the Treaty of Versailles. The German population suffered the collapse of their nation's economy and government along with becoming the international community's scapegoat. Yet despite the troubles caused by the war, Germany returned to start another global conflict led by Adolf Hitler and the Nazi Party just 21 years after the conclusion of the last one. How did the Nazis manage to convince the German public that their country needed to re-militarize and prepare for a coming war despite the defeat of World War I and its devastating effects? This was done through a methodical process between the years 1927 and 1941 involving three distinct steps and relied heavily on the Nazi propaganda machine and the party's leadership. Support for the German military was built by first establishing a specific and desirable German community, then by convincing this community that their troubles were created by an international system that was unjustly punishing them through the Versailles Treaty, and finally by assuring them that the only protection from this tyrannical international order and other malevolent internal and external forces was a strong German military.

11:30 am - 12:00 pm *"Hail, Hail, Cooperation": The Providence Cooperative Farm and Economic Democracy in Holmes County, Mississippi*
Jeffrey K. Walters
Faculty Sponsor: Timothy Huebner, Department of History
From 1942 to 1956, Holmes County, Mississippi was home to a radical experiment in agricultural communalism and economic democracy. "Hail, Hail, Cooperation" is an account of

the short history of the Providence Cooperative Farm and its influence on black Holmes County residents alongside the burgeoning movement for civil rights in the post-World War II era. At Providence, members pooled their resources to establish a community institution that increased access to education, daily necessities, and health services otherwise inaccessible to black residents in Holmes County. The cooperative laid a foundation for local activism, a model that is under-recognized for its historical role in transforming daily life in the rural South through cooperative economics. An innovative and radical reaction to decades of the racial and economic subjugation that typified black experience in the Mississippi Delta, the cooperators at Providence constructed a democratic economy that undermined the traditional Jim Crow structures of Holmes County and, more broadly, the American South.

12:00 - 12:30 pm *The Vietminh's Rural Revolution: Ho Chi Minh, Vo Ngyuen Giap, and the Fight to Defeat French Colonialism*
Alex McTaggart
Faculty Sponsor: Michael Drompp and Robert Saxe, Department of History
In the mid 20th century, wars of national liberation erupted around the globe as colonized nations fought for their independence. While often overlooked in the broader historical conversation, the First Indochina War between the Vietnamese and the French was one of the most important conflicts of this era. Under the leadership of Ho Chi Minh and Vo Ngyuen Giap, the Vietminh was established as a revolutionary and anti-colonial army tasked with the goal of freeing Vietnam from French control. Facing a modernized military power with limited resources and inexperienced soldiers, Ho and Giap knew that in order to succeed, they needed to mobilize a large portion of the Vietnamese population to support their cause. Guided by this principle, the Vietminh sought to capitalize on the intense anger the Vietnamese rural masses had towards French rule by drawing on the experience of eight decades of colonial abuses. Through policies that linked Vietnamese peasant's demands for economic and social equality with the anti-imperial struggle, Ho and Giap established a 'Rural Revolution' that liberated Vietnam from colonial rule and created a blueprint for the war against the Americans in the decades to follow.

<u>Spanish Senior Seminar I</u>
11:30 am – 1:15 pm
Language Center
Moderator: Elizabeth Pettinaroli

Carmen de Burgos: La mujer moderna
Marlena Roberson-Bullard
Faculty Sponsor: Elizabeth Pettinaroli, Department of Modern Languages & Literatures
Carmen de Burgos has created works of literature that contribute to the rights of women in reference to divorce, equality, and the female movement. In my research, I will explore the

works of Carmen de Burgos in reference to her views of feminism. In particular, in her work *Divorce in Spain*, which depicts her desire for divorce has an influence on her short stories. *Divorce in Spain* is a collection of essays, interviews, and facts about the effects of unequal and arranged marriages. The study begins with an analysis of the work along with the historical context of Carmen de Burgos's generation as well. Both create the foundation for the transition to the analysis of the story "The Cold woman." This story consists of feminist ideas that exist in reference to Carmen de Burgos and support her feministic ideas that exist in the *Divorce in Spain*.

Afro-centric Spiritual Practices in Latinx Literature
Katrina Schweitzer
Faculty Sponsor: Elizabeth Pettinaroli, Department of Modern Languages & Literatures
The analysis of the afro-centric spiritual practice of Santería in latinx literature through the critical lense of colonization.

Masculinities in El Salvador: Beyond Machismo
Lillie Stephens
Faculty Sponsor: Elizabeth Pettinaroli, Department of Modern Languages & Literatures
Masculinity in Latin America is frequently reduced to machismo: a term that is absolute, universal, and finite. Especially in regard to El Salvador, where violence has been a key part of their history and society, there is a tendency to write off certain problems as given elements of machismo. However, Salvadoran literature reveals many distinct aspects of masculinity outside of the label of machismo. Australian sociologist R.W. Connell first introduced the idea that there are multiple masculinities. This project uses Connell's theory of hegemonic masculinity to analyze how masculinities manifest in different ways throughout the novel Cuzcatlán: donde bate la mar del sur by Manlio Argueta and the short story "Paternidad" by Horacio Castellanos Moya. These works, illuminated by Connell's theory, show that there is not a single form of Salvadoran masculinity. In this essay, I use these works to problematize the notion of machismo and analyze manifestations of masculinity with respect to the familial structure, violence, and the loss of cultural identity. Finally, I examine the impact of the Civil War on Salvadoran masculinities.

The Deconstruction of Binary Ideological Schemes and the Postmodernist Space in Kiss of the Spider Women
Dylan Craddock
Faculty Sponsor: Elizabeth Pettinaroli, Department of Modern Languages & Literatures
La novela, El beso de la mujer araña escrita por Manuel Puig, se trata de la historia entre Molina y Valentín, dos hombres que están en la cárcel en Argentina en los años setentas. Molina está en la cárcel por "corrupción de los menores" o en realidad por ser gay, mientras Valentín está allí a causa de sus acciones políticas con un grupo revolucionario. Para pasar el tiempo, Molina narra

algunas películas de Hollywood que ha visto mientras Valentín le interrumpe con preguntas y reacciones. Eventualmente estos hombres diferentes, que ocupan y que se suscriben a mundos radicalmente diferentes (y aún más, a identidades construidas de maneras diferentes), forman una relación muy intima y se convierten en amantes. La confusión entre la realidad y la fantasía, la heterosexualidad y la homosexualidad y la masculinidad y la feminidad en la novela sugiere que haya una multiplicidad de las desarrollas de la identidad. Más aún, la obra nos permite a explorar cómo los personajes forman una identidad y cómo esta formación cambia cuando el binario impuesto de la sociedad desaparece. En total, este proyecto se trata de describir cómo Manuel Puig crea un espacio postmodernista a través de la narrativa y la estructura de esta novela y cómo él ofrece un rechazo enorme de la tendencia de poner la humanidad en un binario y no en un sistema de la multiplicidad.

Pedro Paramo: A Trauma Studies Analysis on Post-revolutionary Mexico

Reba Moody

Faculty Sponsor: Elizabeth Pettinaroli, Department of Modern Languages & Literatures

Pedro Páramo fue escrito por Juan Rulfo en 1955 después de la época revolucionaria de México, un tiempo que cambio esta región completamente en varias maneras culturales, sociales y políticas. Esta novela se trata de analizar el viaje de Juan Parecido, uno de los muchos hijos de Pedro Páramo. El destino de Juan es el pueblo de Comala y está lleno de fantasmas de la gente que fue afectada por los abusos y acciones malas del padre del Pedro cuyos producen trauma en los personajes de Comala. El estudio del trauma en las obras literarias ha cambiado mucho desde su principio. Muchos críticos de esta teoría se enfocan en la crítica poscolonial ya que históricamente ha habido eventos traumáticos de muchos países, culturas y grupos de personas. La meta final de los estudios de trauma es desarrollar la capacidad de leer las heridas de esas personas a través de la literatura (Hartman 537). Este proyecto estudia cómo Juan Rulfo concibe la elaboración de los recuerdos traumáticos de la gente rural de México de una manera holística, y su exploración de la imposibilidad de estos personajes de escapar este pueblo desierto.

Analysis of El Hablador: The Modernization of Perú at the Expense of Indigenous Culture

Richard Lucarelli

Faculty Sponsor: Elizabeth Pettinaroli, Department of Modern Languages & Literatures

El Hablador de Mario Vargas Llosa es una novela que trata de los temas de poder, violencia, colonialismo, corrupción política, y la potencial del cambio social a través de una lente antropológica y etnológica. En la novela, Mario Vargas Llosa presenta diferentes perspectivas sobre el rol del indígena en la modernidad. La obra de este autor ganador del premio Nobel es un espacio literario en el que los lectores pueden reflexionar sobre la aculturación y los embates de la modernidad en mayor escala en múltiples lugares de América Latina y en otras partes del mundo. En este proyecto estaré siguiendo la trayectoria de la destrucción de la cultura indígena y su contexto, según se presenta en la obra. Además, analizaré dos perspectivas, los del narrador y

Saúl, sobre la aculturación como estrategia para lograr la homogeneidad necesaria para arribar a ciertos modelos de modernidad colectiva. Estas perspectivas reflexionan sobre el debate en el cual se dirime la compatibilidad o incompatibilidad entre lo moderno y lo indígena. Con este último paso, este proyecto presentará una crítica de la manera polarizada de pensar para reflexionar sobre la posibilidad de un "pluriverso," una opción tercera para concebir el espacio de lo indígena en la actualidad.

History of the 20th Century
1:00-2:00 pm
Buckman 200
Moderator: Chandler Vaught

1:00-1:20pm *The Abe Fortas Collection* ◙
Jacob Moore
Faculty Sponsor: Timothy Huebner, Department of History
This presentation focuses on my 2018 work organizing and processing the papers of Abe Fortas contained in the Rhodes College Archives. Fortas graduated from Rhodes (then Southwestern) in 1930 and went to Yale Law School where he served as editor of the law review. After graduation he spent many years working as one of the top lawyers of FDR's New Deal program before becoming a private practice attorney. As a private attorney Fortas fought vehemently against Senator Joseph McCarthy's witch hunt for communists and argued multiple cases before the Supreme Court, including Gideon v. Wainwright in 1962. In 1965 President Lyndon Johnson appointed Fortas to the Supreme Court of the United States, from which he retired after a failed chief justice nomination in 1969. The Fortas Collection that I assembled, under the supervision of archivist Bill Short, contains 912 items that closely and intimately chronicle the life and times of Rhodes College's most distinguished graduate.

1:20-1:40pm *Radicals in the Rural: Two Cooperative Farms and Economic Democracy in Holmes County, Mississippi*
Jeffrey K. Walters
Faculty Sponsor: Russell Wigginton, Vice President of Student Life, Dean of Students
Long buried under the weight of Mississippi historical memory, Holmes County was home to two radical experiments in agricultural communalism and economic self-sufficiency in the mid-twentieth century. "Radicals in the Rural" is an account of these communities and their broader impact on the early African American freedom struggle in the Mississippi Delta. For twenty years, the Mileston and Providence cooperative farms evaded the plantation economy of the Delta by building democratic economies that undermined the Jim Crow status quo. The projects grew out of the intellectual and activist spaces of New Deal-era politics and reform, capitalizing on partnerships with the federal government and private reformers. Former sharecroppers and

◙ Rhodes Fellowship

tenant farmers owned their labor and pooled their resources to increase access to land ownership, education, and health. Cooperators built schools, health centers, and community stores, and distributed land among its members to ensure economic and personal security. Radical in nature, the cooperatives angered white supremacist leaders and organizations, leading to their downfall in the era of massive resistance. The brief formal existence of the cooperatives, however, laid a foundation for local activism that continued long after their proper dissolution, rooted in a tradition of economic democracy and black self-help. Though the role of cooperatives in early African American activism is often forgotten, the Mileston and Providence cooperatives were radical, transformative spaces that served rural black families in Holmes County and undermined the traditional structures of the segregated South.

1:40-2:00pm *The Prophet of the West: Oswald Spengler's Caesarism in Weimar Germany*
Matthew Broussard
Faculty Sponsor: Jeffrey Jackson, Department of History
In 1918, as the First World War drew to a close, a virtually unknown historian named Oswald Spengler published the first volume of his magnum opus Der Untergang des Abendlandes, The Decline of the West. Spengler's philosophy of history, which saw the cultures of the past as organisms that undergo evolution, immediately sparked interest among early twentieth century German intellectuals. Unlike other works of history, Spengler's volume also included a prophecy. He wrote that the West had come to the end of its life and that one powerful man, a Caesar, would rise above the corrupting influences of democracy and degeneration in order to lead the masses into a revival of Western culture. To a nation in distress, Spengler's prophesied Caesarism was understandably appealing. Though it was not Spengler's intent, Caesarism would pave the way for the rise of fascism in Germany. Caesarism offered totalitarian certainty in a time of nihilistic chaos, something Adolf Hitler and the National Socialists would appropriate. Though Spengler was poised to become the most famous intellectual in Germany when the Nazis came to power, the historian refused to ally himself with them. After multiple recruitment attempts from the highest levels of German government, Spengler was finally blacklisted from the press and forgotten. With or without Spengler, Hitler would portray himself as Caesar. The Nazi appropriation of Caesarism highlights the importance of crisis to fascism's success: if a would-be dictator can present himself as a Caesar during a time of crisis, he will attain power.

Churches, Retreats, and Vampires: Religious Studies Senior Seminar
1:00-2:00 pm
Southwestern Hall 210
Moderator: Marie Vencil

1:00-1:20pm *The Church's True Colors: Examining the Hope for Diversity in Memphis Churches*

Spencer Beckman
Faculty Sponsor: Bernadette McNary-Zak, Department of Religious Studies
Memphis, Tennessee is considered one of the least diverse cities in the United States. Yet, diversity is a concern for many local church leaders. This ethnographic research draws from interviews with church leadership at three local Protestant churches that have officially and publicly stated their desire to house a diverse congregation. This research locates operative definitions of diversity, and examines how and why church leadership cares about diversity within their congregations.

1:20-1:40pm *From Religious to Therapeutic: An Analysis of the United States' Detraditionalization of Thai Vipassanā Meditation Retreats*
Kourtney Patton
Faculty Sponsor: Bernadette McNary-Zak, Department of Religious Studies
In the United States, Thai vipassanā meditation retreats have been adopted and changed for secular therapeutic purposes. However, in Thailand these retreats have seemingly little if any therapeutic ends. My ethnographic research demonstrates that American secular therapeutic meditation detraditionalizes Thai vipassanā meditation retreats. Detraditionalization occurs primarily through cultural appropriation and employs a capitalist spirituality. Detraditionalization challenges American meditators' expectations and raises mental health concerns for those unprepared for the "Dark Nights" of vipassanā meditation.

1:40-2:00pm *What's at Stake: Vampiric Christian Bodies*
Elizabeth Dinneny
Faculty Sponsor: Bernadette McNary-Zak, Department of Religious Studies
Vampires have fascinated readers for centuries. From Nosferatu and Count Dracula to Edward Cullen and Lady Gaga, the vampire's form varies significantly depending on cultural contexts, anxieties, and fantasies. Despite these variations, vampiric imagery is rooted in Christianity. My paper is interested in the vampire within its inherently Christian context and the implications of a monster that is not as hellish as we like to think. Typically read as demonic, I argue that the vampire is more a mirror of Christ than his antithesis. Through a charitable analysis of the vampire, I hope to deconstruct its horror and uncover alternative modes of identification with Christ. The immortal vampire's interaction with Christian history and ritual practice indicates an eternal respect for the religion and its central figure. Though unconventional, I find the vampire to be a Christian image.

Spanish Senior Seminar II
1:30-3:00 pm
Language Center
Moderator: Elizabeth Pettinaroli

1:30-1:45 pm *Tres años para nacer: Educational Justice and Decolonization in the Testimonial Writing of a "Machuca"*
Mimi Yacoubian
Faculty Sponsor: Elizabeth Pettinaroli, Department of Modern Languages & Literatures
Este proyecto se concentra en el libro, Tres años para nacer, que inspiró una gran parte de la película Machuca. En su recuento personal el autor Eledín Parraguez narra la experiencia de un estudiante de clase pobre que fue integrado junto a otros estudiantes de la misma condición en un colegio privado. Este programa de integración educativa y social fue creado por las curas de una comunidad religiosa en Santiago de Chile durante el periodo el gobierno socialista de Salvador Allende. Fue una experiencia difícil y dura a debido del contraste cultural y material entre los estudiantes pobres y ricos. Esta integración fue interrumpida por el golpe de estado, que destruyo al gobierno socialista. Esta obra muestra una perspectiva de la experiencia de Parraguez a diferencia de la que se ve en la película Machuca. En conversación con las teorías de Walter Mignolo, Hayden White, John Beverly, Kimberly Nance, Paulo Freire en este proyecto se explora la causa de Eledín y su deseo para conversar con personas sobre su experiencia, y cómo es relevante para la experiencia de Chile hoy día.

1:45-2:00 pm *Translingualism and Decolonization of Linguistic Binaries*
Emily Forehand
Faculty Sponsor: Elizabeth Pettinaroli, Department of Modern Languages & Literatures
Metalinguistics and transculturation are impacting phenomena that are key to the study of translingualism. This term has suggested a new way of analyzing sociolinguistic studies and is a fundamental aspect of linguistic decolonization. "The Politics of Translingualism" by Jerry Won Lee introduces this theory that promotes the abandonment of preconceived notions, misconceptions, and negative aspects of language within strict barriers, formed by socio-political constructions. Translingualism is a profound aspect of decolonization. Together, these terms are manifested in the central texts, "How the Garcia girls lost their accents" by Julia Alvarez and "Fiesta 1980" from the collection, "Negocios" by Junot Díaz. This project proposes that translingualism, a phenomenon that describes the diverse use of language, has a perspective that conceives linguistic and cultural plurality equally valid. It is a key theory that corresponds with decolonization, a term that Walter Mignolo proposes to abandon binary perspectives of language. These theories reject prejudices in the process of assimilation, as is seen in the central texts. Specifically, in the aspects of movement between strict borders of transculturation and the notion of discursive construction versus ontological actuality with respect to linguistic hierarchy.

2:00-2:15 pm *The Role of the Camera in Cortazar's Surrealist Worlds*
McKendree Walker
Faculty Sponsor: Elizabeth Pettinaroli, Department of Modern Languages & Literatures

"Este proyecto explora el papel de la cámara de los dos cuentos “Las babas del diablo” y “Apocalipsis de Solentiname” de Julio Cortázar. Roberto Michel y Julio Cortázar, los protagonistas de los cuentos, usan la fotografía para preservar y comprender sus emociones. Emociones que las palabras no pueden describir. Ambas historias surrealistas exploran el deseo del fotógrafo a capturar algo de valor. Pero al otro lado la cámara también funciona como una guía para que estos personajes den sentido a sus propios mundos. Este proyecto explora la psicología detrás de la inspiración del fotógrafo y cómo la foto se convierte en una preservación tangible de la ""realidad"" en sus mundos que están totalmente separados de la realidad. En ambas historias, el fotógrafo se siente atraído por su tema debido a su aura familiar, lo que significa que el fotógrafo ve una parte de sí mismo en el tema. ¿Es la fotografía una forma en que los humanos pueden acceder a emociones y memorias reprimidas? Este proyecto se centrará en la correlación entre la psicología y la fotografía, y cómo ambos trabajan juntos en los cuentos de Julio Cortazar."

2:15-2:30 pm *The Literary Che and Postmodern Geographies: Placemaking in Latin America*
Zachary Abdo
Faculty Sponsor: Elizabeth Pettinaroli, Department of Modern Languages & Literatures
Este proyecto llevará a cabo un análisis de la poesía y narrativa de Ernesto “Che” Guevara entre 1953 y 1956, explorando los temas literarios de cada poema y la manera en que construye el espacio Latinoamericano como “teatro de sus aventuras”. Al considerarla noción de espacio y lugar del crítico Edward Soja en su Postmodern Geographies: The Reassertion of Space in Critical Social Theory, se encuentra que El Ché Guevara forma y reforma el paisaje, y revela una nueva imaginación geográfica para la región. Los tres poemas que constituyen el cuerpo de esta investigación son parte del cuaderno Che testimoniante compilado por el Centro de Estudios Che Guevara y el Centro Cultural Pablo de la Torriente Brau. En octubre de 1998 se publicó la primera edición, y una reedición se publicó en octubre del año 2012. Esta segunda edición es la base del estudio literario de la poesía de Guevara. El cuaderno contiene notas de viaje, cartas, poemas, crónicas, y fotos (todo hecho por su propia mano), y la parte literaria de esta investigación se trata principalmente de los tres siguientes poemas: “Palenque”, “A los mineros de Bolivia” y “Una lágrima hacia ti”. Seguirá una línea de tiempo cronológica con respecto al análisis literario de los tres poemas para que se pueda investigar el crecimiento literario de Guevara entre los años 1953 y 1956.

2:30-3:00 pm *The Construction of Place in Bordered Spaces in Señales que precederán al fin del mundo*
Tevin Mathew
Faculty Sponsor: Elizabeth Pettinaroli, Department of Modern Languages & Literatures
In the novel Señales que precederán al fin del mundo by Yuri Herrera, Makina leaves her home in Mexico and crosses the border with the United States to find her brother. During her journey,

she travels through various spaces. Her trilingualism (her native language, the latin language, and anglo) allows her to have the agency to interact with certain types of communities within these spaces. The fluidity of her linguistic knowledge parallels her spatial fluidity. In The Fate of Place, Edward Casey emphasizes that space is not absolute and place is not permanent (297). In Makina's case, her concept of home changes through her journey. This project explores the displacement of Makina from one side of the border to another as a process that results in the construction of a new place for Makina. Her spatial fluidity in addition to her linguistic fluidity change her mentality and framework the complex process of negotiation in the construction of place when bordered.

Art and the Bible
1:30-2:15 pm
Southwestern 207
Moderator: Jane Eskildsen

1:30-1:55 pm *Musical Reinforcement and Amplification of Biblical Misogyny*
Mackenzie Gibbs
Faculty Sponsor: Steve McKenzie, Department of Religious Studies
In this presentation, I explore the misogyny presented in Norman Span's song "Man Smart (Woman Smarter)" and the implications of its rhetorical support by the Bible[WU1] . The song references 5 characters from the Hebrew Bible: Adam & Eve from Genesis 3, Samson and Delilah from Judges 16, and Methuselah from Genesis 5. Span's argument[WU2] , using these passages as support, is that women exercise their intellectual superiority over men to emotionally manipulate them for their own personal gain. It is clear that because of their misogynistic themes, the passages above aid Span in crafting his argument. However, comparing the lyrics with the text reveals some significant discrepancies. In the stories from Judges 16 andGenesis 3, Span shifts the blame for tribulation [WU3] from the male characters to the female ones, giving them distinctly more sexist tones. His reference to Methuselah has no textual truth to it and it tells of a woman completely destroying his life. Span takes the multi-layered stories in the Hebrew Bible and changes them to fit his one-track agenda. In doing this, he becomes the object of his own critique, using a position of societal power to put others down for personal gain. Because Span and all the biblical authors are dead, they no longer have authority over their work and the messages that it spreads. As such, the responsibility to cope with these ideas shifts to the pop culture consumer.

1:55-2:15 pm *Suffering in the Penitent Magdalene: Influence, Innovation, and Implications*
Gracie Collier
Faculty Sponsor: Victor Coonin, Department of Art & Art History

Traditionally, scholars have read the Aeneid as a piece of propaganda for the Augustan empire. But in his Two Voices of the Aeneid, Parry, rejecting the historicist reading, brings attention to elements critical of the said empire, which decisively divided the interpreters into the "Harvard School['s]" pessimistic readings and those who maintain the traditional "optimistic readings" (Kallendorf). Some recent scholars have tried to seek unity between these two readings by adopting thesis similar to Parry's reading (Schmidt), which interprets the Aeneid as an artistic expression with humanistic sympathies (Parry). But their prioritization of instances of textual analysis, like the historicist they criticize, also allows isolated themes to overshadow the structural context in which each scene occurs, thus segmenting Virgil's narrative as a unified whole. In an attempt to reveal this unity, this paper prioritizes the sequence of events in interpreting the symbols within the scenes analyzed by Parry and the significance of these scenes to the whole. The paper offers a third perspective that reconstructs the idealistic social-political narrative presented in the Aeneid on its own terms.

Theory and Struggle in Algeria
2:30-3:15 pm
Southwestern 207
Moderator: Jacob Moore

2:30-2:55 pm *Exposing French Colonial Atrocities: Jean-Paul Sartre's Perspectives on the Algerian War*
Marie Vencil
Faculty Sponsor: Etty Terem, Department of History
This research will investigate how Sartre responds to France's colonial involvement in Algeria during the Algerian War. Ultimately, Sartre criticizes his own country's involvement in the Algerian War through articles and commentaries, such as "Colonialism is a System," "You Are Wonderful," "We Are All Murderers," "A Victory," and the preface to Franz Fanon's "The Wretched of the Earth." Through his writings, Sartre outlines the destructive nature of both colonialism and the use of the torture, which enforce a cycle of violence that continues throughout the war. Sartre blames the French for worsening the conflict with their harsh military court judgments and increasingly brutal reprisals against the FLN, which deepen the divide between the Muslim Algerian population and the French administration. He confronts the French government for using similar interrogation methods as the Nazi regime and for censoring the press, trying to keep the French public ignorant of their immoral actions. Comparing the French public to the German people under the Nazi regime, Sartre condemns his fellow Frenchmen for taking a passive stance, faking ignorance to the wrongs committed by the French army in Algeria. Overall, Sartre believes in Algerian independence, validating the resistance's use of terror tactics against the French.

2:55-3:15 pm *French Intellectual Engagement with Torture Testimonies during the Algerian War*
Rachel Heimann
Faculty Sponsor: Etty Terem, Department of History
My research concentrates on French intellectuals, Jean-Paul Sartre and Simone de Beauvoir, and their writings on torture testimonies during the Algerian war. The subtext of Sartre's and Beauvoir's writings played upon patriotic prose to denounce racist colonialism, complicity, and the betrayal of French principles. Moreover, Sartre's and Beauvoir's moralistic discourse embraced major themes of humanism, hypocrisy, and responsibility. Although Sartre and Beauvoir share an overarching opinion on torture, they diverge in their understanding and implication of the individual suffering for the authors of torture testimonies. For Sartre, torture created a dialectical relationship with a sort of reciprocity between the victim and perpetrator of shared degradation. Sartre's angry polemic, demonstrates a macho bravado contextualization of Henri Alleg's experience: his silence was a heroic act of martyrdom- something all of France can take pride in - and a transcendence of the inhumanity engrained into the act of torture. Beauvoir saw no such redemption in Djamila Boupacha's suffering; rather, she depicted her suffering as an irremediable scandalous banality. Boupacha's singular suffering, and that of the thousands of unknown Algerians, represented the human reality for victims of torture, which was the source of France's national failure and shame.

Philosophy: Sex, Sound, and Disobedience
2:30-3:30 pm
Southwestern 210
Moderator: Katrina Schweitzer

2:30-2:50 pm *On Martyrdom and Civil Disobedience*
Emily Haas
Faculty Sponsor: Pat Shade, Department of Philosophy
Martyrdom represents a major obstacle when diving into religious literature because oftentimes modern audiences are not able to extract the meaning from their stories and are instead distracted by the foreign nature of their struggles. Self-sacrifice in name of faith of is not a familiar concept, and a seemingly more secular, but politically active generation needs a new lens to look at martyrdom with. We find that relatability in people like Dr. Martin Luther King Jr., with the act of civil disobedience. Through a careful analysis of arguments presented by John Rawls, MLK, and St. Perpetua, there are clear parallels that can be drawn between martyrdom and civil disobedience. Reframing and starting to break down formerly complex issues open up new avenues of discussion which can add value to students' learning. Designed specifically for secular students, the goal of the analysis is to find deeper meanings and stronger connections in religious texts on martyrdom.

2:50-3:10 pm *Killing, Consent, and Kinky Sex: An Ethical Defense of Autassassinophilia*
Aynabeth Anderson
Faculty Sponsor: Rebecca Tuvel, Department of Philosophy
As many ethicists concern themselves with questions regarding medically assisted suicide, I wish to take the discussion one step further. In this paper, I use an argument by analogy to assert the moral permissibility of sexual killing (autassassinophilia). Through the exploration of two stories, that of Dr. Jones and Rita and of Sue and Jamie, I argue that medically assisted suicide is not morally relevantly different to that of sexual killing. Dr. Jones is an elderly care doctor who is tasked with taking care of Rita, a woman who wants nothing more than to die. Sue is a big time executive at a law firm who enjoys speaking to other women, like Jamie, on underground, fetish chat sites and seeks to be killed. Though these two scenarios seem rather different, I argue that, if a being is rational, healthy, and suffers no outside coercion, they should be able to dictate what happens to their body, even if this means allowing for death. At its core, my paper is an argument for full bodily autonomy for all people and call for justice for people who have committed acts like Jamie. Likewise, I explore how our moral intuitions around sexual killing lead us in various directions regarding consent, pleasure, and the authority we grant to medical staff. I conclude by offering a space with which to further explore this topic in Ethics.

3:10-3:30 pm *The Metaphysics of Sound and Causation*
William Morrow
Faculty Sponsor: Rebecca Tuvel, Department of Philosophy
What exactly do we mean when we say we hear something? Furthermore, what is it that we are actually hearing? The most common answer is that it is a sound that we hear, but is such a sound an object, or an event? Is it a property, or an individual? These questions and more are what have given rise to the field of auditory perception. My research revolves around the metaphysical relationship that exists between sounds and their sources. Specifically, my work focuses on the role causation plays when analyzing such a relationship. In my paper, I advance a distinct causal theory which has exclusively been applied to the realism debate within Philosophy of Science and subsequently make the case for applying it to the metaphysics of sound. The causal account for which I advocate posits that we should abandon the notion of viewing causation as a process that occurs between distinct events and instead conceptualize it as the continuous interaction of properties between particular objects/substances which possess specific dispositions for certain behavior. By implementing such an intuitive metaphysical account to auditory perception, a field which is in its primitive stages, we are presented with undoubtedly novel, exciting results.

<u>Russian Language and Thought</u>
3:30-4:30 pm
Southwestern 207

Moderator: Alexandra Kostina

3:30-3:50 pm *Development of Church-State Relations in Russia from 988 to 2019*
Emily A. Perry
Faculty Sponsor: Alexandra Kostina, Department of Modern Languages & Literatures
Throughout Russian History, the cultural and political influence of the Orthodox Church cannot be ignored. From the outset of St. Vladimir's baptism, Christianity was formed into political tool, as it continued to be during the Russian Empire, when Christianity served as validation for the monarchy's authority. Yet, the country's adoption of Christianity was genuine, so much so that the Soviet Union, beginning in 1917, sought to subdue the faith, but was never successful, as citizens of the USSR continually looked to the Orthodox Church for reassurance and empowerment. With such history and influence in mind, how do the Russian people view Orthodoxy today, especially in the midst of secularism throughout the West and the Russian Orthodox Patriarchate once again being involved in the public sphere.

3:50-4:10 pm *Russian Feminist Thought: A Movement Marked by History and Culture*
Kelsey McClain
Faculty Sponsor: Alexandra Kostina, Department of Modern Languages & Literatures
With Russia's relatively recent bad press in regards to gender and sexuality political reform, I sought to contextualize the idea of "Russian feminism" by examining its historical and cultural roots. Though the idea of gender is relatively new (the word "гендер" didn't exist until 1991), Russian feminist thought dates back to the 18th century and has developed alongside other major revolutionary movements within the country. With popular figures such as Alexander Pushkin writing about the increased independence of women combined with actual Russian aristocracy such as Catherine the Great opening the door for higher education for women, Russian feminism can be traced through iconic cultural figures in literature and politics. Throughout it all, Russian feminists have crafted an ideology suited for their reality and separate from traditional Western thought. Note: Presentation to be given in Russian.

4:10-4:30 pm *Translating Shtoss: Theory into Practice*
Emily A. Perry
Faculty Sponsor: Alexandra Kostina and Anna Efimova, Department of Modern Languages & Literatures
This presentation will discuss translation as a set of linguistic and interpretive skills that assist the translator in making best choices among possible translation solutions. It will use Lermontov's unfinished story "Shtoss" to illustrate how theory becomes practice and how this "exact art" or "inexact science" operates on a practical level.

Ancient *Artes*: Greek and Roman Studies
3:30-5:15 pm
Language Center
Moderator: David Sick

3:30-3:45 pm *The Context of Symptomology*
Terra Martin
Faculty Sponsor: Susan Satterfield, Department of Greek & Roman Studies
As a society, we are often captivated by plagues and the destruction they carry with them. These events leave lasting impacts on their victims, and those of the Ancient World are no different. We can now look back on those who experienced the most impactful plagues and gain a better understanding of the situations and context surrounding them. By reading the likes of Thucydides, Galen, and Saint Cyprian and analyzing the structure and content of their writings we may also experience what it was like to live through these catastrophic events. The effects on their writings are seen in various ways, whether in the breaking of an unbiased façade, the detailed recording for posterity, or the plea to remain faithful under grave circumstances. All of these stylistic choices bring us closer to the context that is, the lives of those who were touched by plagues.

3:50-4:05 pm *Greco-Roman Perceptions of Egypt and India in Philostratus' Apollonius of Tyana*
Marie Vencil
Faculty Sponsor: Susan Satterfield, Department of Greek & Roman Studies
Bilingualism in Latino poetry was initially viewed through a deficit lens, in which switching back and forth between languages was regarded as the result of insufficient language abilities. More recent scholarship has instead approached bilingual Latino poetry through a socio-linguistic lens, revealing "code-switching" to be a literary tactic allowing bilingual writers to more fully express their identities and experiences, which both traverse and inhabit linguistic, cultural, and ethnic boundaries. Thus the idea of linguistic and cultural "in-betweenness" has often been used to describe the experience of being "stuck between two worlds," a common theme in Latino poetry. But are such binaristic categorizations—of bilingual, of being caught between two worlds—an oversimplification of a much more complex, multilingual and multicultural reality? In this presentation, I will argue that these binaristic frameworks often prove insufficient to articulate the nuanced and multi-faceted nature of many Latino American experiences with language. The analysis of a representative corpus of Latino poetry (some written mostly in Spanish, some written mostly in English, and some defying strict, either-or categorization) focused on linguistic matters will allow me to propose a critical framework of multilingualism—a framework whose borders are permeable, unfixed, and wide enough to engage the diversity of Englishes, Spanishes, both y más that characterize Latino poetry.

4:10-4:25 pm *The Femme Connection: Rome and the Ladies Next Door*
John Ford
Faculty Sponsor: Susan Satterfield, Department of Greek & Roman Studies
The point of my paper is to show that ancient Rome developed many of their stereotypes about their neighbors based off these said neighbors' treatment of women and their level of egalitarianism. Previous studies have not touched on this topic in direct fashion, but have provided much evidence of Roman treatment of women as well as their neighbors' treatment of their own women, allowing us a greater degree of insight into the topic and a greater ability to make and examine comparisons between these societies. Examples shall include: the famous Cleopatra VII of Egypt, the last Greek ruler of Egypt and very famous in modern popular culture; Boudicca, the warrior queen of the Iceni in modern Britain who revolted after mistreatment by the local Roman authorities, and who burned down ancient London; the women of Etruscan society, who were famous throughout the ancient world for their unheard-of levels of personal freedom in the ancient world; and others. Because the norm for Roman society was that women were less than men, not only legally but biologically, these examples are very important exceptions to the rule. I will argue, using these examples, that their positions in society shaped the Romans' mental image of each society, taking into account each society's level of egalitarianism and each example's position in said societies. Women in ancient societies around Rome were very powerful when it came to shaping the Romans' ideas.

4:30-4:45 pm *Nero the Artist: Was he serious about his practice or was it just a hobby?*
Camila Zimmerman
Faculty Sponsor: Susan Satterfield, Department of Greek & Roman Studies
The Emperor Nero liked to partake in many forms of the arts, such as acting, singing, playing the cithara, and painting. But because musicians were generally foreigners or slaves, many people (mainly the upper class and the Senate) considered Nero's performances not just highly improper, but also a disgrace to his name. The writings that we have about Nero are mostly by these people in the upper class and of senatorial rank, creating a very one-sided view of Nero as a performer. It is entirely possible that Nero was an awful performer and that no one liked him as one, but it is also possible that he was actually very good and that the populace liked him. We cannot know any of this for sure. However, what we can note are the preparations that Nero made for these musical contests and his actions there which display how important performance was to him. I will discuss Nero as a performer and argue that he took performing seriously in all aspects, not just on stage. I will do this by looking at his study habits and his performances on his tour from Naples to Greece to Rome through sources such as Tacitus and Suetonius.

4:45-5:00 pm *In Vino Veritas, In Educatione Facultas: The Effects of Education on Wine Production in Ancient Campania*

Tessa Marconi
Faculty Sponsor: Susan Satterfield, Department of Greek & Roman Studies
This paper explores the effect education – both formal and informal – had on the quality of wine produced in the region of ancient Campania. I chose this region of the Italian peninsula because both ancient and contemporary sources agree that Campania was – and still is – one of the leading wine producers in the Mediterranean world, and many ancient authors, such as Pliny the Elder and Columella focused their agricultural writings on this area of the Italian peninsula. Additionally, the region of Campania had several important ports and cities and was popular among the Roman elite, factors that could have had an impact on the education of the region's citizens. The practice of viticulture has been a hallmark in civilization even before the ancient Roman world. The domestication of the vitis vinifera grapevine marked a shift in civilization that changed the cultural, economical, religious, and technological history of the world. As wine became more and more popular in trade, the demand for sophisticated wine production increased. This increased demand begs the question of whether it was important for a vintner to be educated in order to produce quality wine. That question is exactly what this thesis explores: how did education impact the quality of wine produced in ancient Campania? Based on my research, I believe my paper successfully makes the argument that education was imperative when it came to producing godlike wine in the ancient world.

5:00-5:15 *Changing the Label: Ancient Roman Education and the Appropriation of the Greek System*
Jane Eskildsen
Faculty Sponsor: Susan Satterfield, Department of Greek and Roman Studies
Scholars debate the roots of Roman education and how indebted the ancient system was to its Greek counterpart. Contemporary Classicists, Anthony Corbeill and Nanette Pascal, have variations of their own argument – that Roman education was still Roman but with Greek values naturalized, assimilated, or adopted into the culture. I argue, however, that Roman education was, in fact, Greek education with a new label and that the Romans took the traditions without due credit to the Greeks. Being taught under the tutelage of Greek instructors, learning from a curriculum grounded in famous classical works by Greek masters, and even traveling to Greece for one's high education are all examples of the profound appropriation of Greek culture within Roman educational life. Grounded in the opinions of ancient Romans themselves, such as Seneca, Cicero, and Quintilian, I describe the education of a Roman student from primary instruction to higher-level education with reference to the original Greek version. In this way, I hope to indicate that the components and very premise of Roman education lay entirely in Greek tradition, along the way dissenting against any possible uniquely Roman aspects.

POSTER SESSION I

Multi-Sports Forum in the Bryan Campus Life Center
11:30 am – 1:30 pm
Poster numbers are listed with each title.

St. Jude Summer Plus Fellowships

Note: *Summer Plus participates will attend a luncheon at 11:30 and will be at their posters toward the end of Poster Session I and again during Poster Session II.*

#1 *Upregulated DBX1 in a murine model of ERMS and human ARMS patients suggests a common link in RMS tumorigenesis* ◙

Kristin Reed; Casey G. Langdon, Department of Oncology, St. Jude Children's Research Hospital; Johnathan Dallman, Kansas State University; Mark E. Hatley, Department of Oncology, St. Jude Children's Research Hospital
Faculty Sponsor: Michael Collins, Department of Biology

Rhabdomyosarcoma (RMS) is the most prevalent childhood soft tissue sarcoma, making up 50% of these tumors. RMS is divided into four categories: embryonal RMS (ERMS), pleomorphic RMS, spindle cell RMS, and alveolar RMS (ARMS). Patients with ARMS are most likely to present with metastasis and have the worst prognoses, especially compared to patients with ERMS, the most common subtype. Patient survival has not improved over the past 30 years, with requisite aggressive treatment often increasing the risk that children will develop additional malignancies later in life and/or experience significant co-morbidities, including disfiguring surgery. Future research into the molecular mechanisms responsible for RMS tumorigenesis aims to improve treatments and clinical outcomes. To better understand the origins of RMS, our laboratory developed a highly penetrant, early onset, Hedgehog-driven ERMS model. Loss of PTEN expression is seen in 90% of ERMS patients, suggesting an important role for the gene in RMS tumorigenesis. Our mouse model has been further augmented by the genetic deletion of the Pten tumor suppressor, resulting in tumors more closely resembling those seen in ERMS patients. Our laboratory identified Developing Brain Homeobox 1 (Dbx1) as the most upregulated gene in these tumors. Interestingly, DBX1 is also upregulated in ARMS patients, in which PTEN expression is not typically altered. To investigate this, a series of gain-and loss-of-function studies will be performed in human ARMS cell lines, patient-derived xenografts, and genetically engineered mouse models. Taken together, our preliminary data suggest a role for DBX1 in both ERMS and ARMS tumorigenesis.

#2 *Visual outcomes after radiation therapy for optic pathway gliomas* ◙

Sophia Quesada; Kenneth Coca, Mary Hoehn, MD, Ibrahim Qaddoumi, MD, Thomas Merchant, DO/PhD, Sahaja Acharya, MD, St. Jude Children's Research Hospital
Faculty Sponsor: David Kabelik, Department of Biology

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Optic pathway glioma (OPG) often results in visual acuity (VA) decline. Radiation therapy (RT) is used to treat OPG and the effect of RT on VA is not well understood. The purpose of this study is to estimate the cumulative incidence of VA decline or improvement after RT and to identify risk factors associated with VA decline. From 1997 to 2017, 40 patients were treated with RT for OPG at a single institution and had baseline VA testing. All patients underwent serial VA testing following completion of RT. Extent of surgery was biopsy in 53% of patients and subtotal resection in 40% of patients. Approximately half the of the patients (48%) were previously treated with chemotherapy. The 3-year cumulative incidence of VA decline was 17.9% (95% Confidence Interval [CI]: 7% – 32.8%) and VA improvement was 16.3% (95% CI: 5.6% - 31.9%) for the eye with worse baseline vision. The 3-year cumulative incidence of VA decline was 13.6% (95% CI:4.8% – 26.9%) and VA improvement was 10.6% (95% CI: 2.6% – 25.2%) for the eye with better baseline vision. On univariate analysis, prechiasmatic compared to postchiasmatic tumor location increased the risk of VA decline (Hazard Ratio: 6.23, 95% Cl: 1.17 – 33.1, p=0.031). Less than 20% of patients with OPG treated with RT will experience VA decline or improvement in either eye within three years of treatment. Prechiasmatic tumors are associated with an increased risk of VA decline. Given that these patients survive well beyond their diagnosis, long-term VA surveillance is of paramount importance.

#3 *ALLSUP - Use of transcranial direct current stimulation of the lateral temporal cortex to improve measures of cognitive function in long-term childhood cancer survivors* ◙

Molly Litten, Kevin Krull, Nicholas Phillips, Pia Banerjee, Cynthia Jones, Jeremy Lawson, Adrienne Studaway, Amira Wassef, Sedigheh Mirzaei, Leslie Robison, Melissa Hudson
Faculty Sponsor: David Kabelik, Department of Biology

Individuals who have undergone childhood Acute Lymphoblastic Leukemia (ALL) cancer treatment see cognitive deficits that persist throughout lifetime. Studies have shown that transcranial direct current stimulation (tDCS) can aid in some of these deficits by using a very low level of constant electrical current to stimulate specific parts of the brain. A previous study showed that anodal tDCS stimulation to the frontal lobe of ALL survivors yielded improvement in these cognitive issues. In ALLSUP, cathodal tDCS suppression to the temporal lobe will be tested by targeting a different pathway that is also affected by the chemotherapy agents used in treating ALL: the hyperconnected Default Mode Network (DMN) pathway. The DMN is specifically associated with attention and working memory, so we predict that cathodal suppression to this hyperconnected pathway will reduce the activity, improving cognitive function. Subjects will be assessed by an NIH Toolbox Cognitive Battery. Our objectives are to estimate the potential efficacy for powering a larger study and to compare the effect of anodal stimulation of the frontal lobe to cathodal suppression of the superior temporal lobe on cognitive performance. We hypothesize that cathodal suppression to the left superior temporal gyrus will be associated with greater improvement in attention and working memory than anodal stimulation to the left frontal cortex in childhood ALL survivors. The results of this study will

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guide the further steps of appropriate interventions for these children and larger studies to determine long term effects.

#4 *Hope in the Face of Unlikely Cure: From Parent's and Physician's Perspective* ◙
Sri Velrajan; Kendra G. Hotz, Department of Religious Studies; Erica C. Kaye M.D. MPH
Faculty Sponsor: Kendra Hotz, Department of Religious Studies
Historically, prognostic communication research has been cross-sectional, retrospective, and reliant on survey methodology, which results in data confounded by selection, information, and recall biases. No studies have utilized recording technology to describe the evolution of prognostic communication across the illness trajectory for children with high-risk cancer. In this paper, we aim to investigate the relationship between high quality prognostic communication and agreement between oncologist (PO) and parents of children with cancer (POCC) perceptions of curability and prognostic understanding. We hypothesize that provision of high-quality prognostic communication will be associated with increased agreement. Mixed methods were used to compare prognostic communication codes applied within initial recorded disease reevaluation conversations with matched validated oncologist/parent surveys, as well as qualitative data from matched semi-structured interviews completed by oncologists, patients, and parents. After triangulating the data, several themes that emerged from the survey responses, interview responses, and the audio recording of the conversation were: 1) POCCs generally had a higher response for likelihood of cure than POs, 2) during surveys, usually POCCs had a difference sense of curability than during the interview, 3) during surveys, POs had a higher response for likelihood of cure than during the interviews, and 4)in general, POCCs had hope despite prognostic uncertainty. This study is the first prospective longitudinal investigation of prognostic communication in pediatric oncology, using audio recording technology to capture medical dialogue. From this, we can develop clinical interventions geared towards improving prognostic understanding, promoting therapeutic alliance, and enhancing overall communication experiences for these patients and families.

#5 *NSD1 is essential for the death of malignant rhabdoid tumors under EZH2 inhibition and could provide insight into better treatment methods* ◙
Margaret Larsen; Yiannis Drosos, Department of Molecular Oncology, St. Jude Children's Research Hospital; Charles Roberts, Department of Molecular Oncology, St. Jude Children's Research Hospital
Faculty Sponsor: Elaine Frawley, Department of Biology
Malignant rhabdoid tumor (MRT) is an aggressive form of cancer that occurs in the kidneys, brain, or soft tissues of pediatric patients. Cell fate and lineage specification are controlled by the chromatin remodeling complex SWI/SNF which mobilizes nucleosomes. Its activity is antagonized by the polycomb repressive complexes (PRC1/2) that silence transcription through the methylation of H3K27. MRT have a mutation in SMARCB1 encoding a core component of

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SWI/SNF chromatin remodeling complex which thus inactivates complex function. To see whether SWI/SNF mutations affected the interactions of the complexes with other subunits, rhabdoid and control cell lines were tested through immunoprecipitation, glycerol sedimentation analysis, and western immunoblots. The histone methyltransferase NSD1 showed the most promise as it has interactions with SWI/SNF and PRC1/2 components only in the control versus the rhabdoid cell lines. Also, a genome-wide screen showed that loss of NSD1 resulted in resistance of the MRT to EZH2 inhibition. Inhibitors of EZH2, a key component of PRC2, have progressed to phase II clinical trials for SMARCB1-mutant cancers. Although the results are promising, some resistance has emerged resulting in the study of NSD1 to help in predicting resistance mechanisms. Quantitative PCR experiments were performed to determine expression levels of PRC2 gene targets, some of which are typically tumor suppressors, in relation to presence of NSD1. So far, the data collected have shown NSD1 as essential for the death of tumor cells under EZH2 inhibition. Therefore, further understanding the mechanism behind resistance will help us better understand malignant rhabdoid tumors.

#6 *Reducing Risk of Necrosis in Children with Recurrent Ependymoma Treated with a Second Course of Irradiation* ◙

Walker Laird, Chia-ho Hua, Jinsoo Uh, Melissa Gargone, and Thomas E. Merchant, Department of Radiation Oncology, St. Jude Children's Research Hospital
Faculty Sponsor: Jonathan FitzGerald, Department of Biology

Radiation necrosis is a potentially devastating complication associated with radiation therapy (RT). Early prediction and prevention would be highly beneficial. This study examined the radiation dose-volume parameters in children who developed brain necrosis after re-irradiation (reRT) for recurrent ependymoma. We analyzed composite RT plans for 31 patients with recurrent ependymoma who received reRT on a prospective trial between 2014 and 2017. The median age of the study group was 9.0 years (range 3.5-20.4 years). Longitudinal MR images were registered to RT dose distributions to determine dose to necrotic regions. Eleven patients developed necrosis involving the brainstem (4 with grade 1 per CTCAE, 3 with grade 3) or brain (1 with grade 1, 3 with grade 3) during or after reRT. The median onset time was 4 months (range, 1.25-12 months) after the start of reRT. Necrosis appeared in medulla, pons, middle cerebellar peduncles, thalamus and frontal, parietal, or occipital lobes. Necrosis occurred only in patients receiving cumulative doses >105 Gy (brainstem, 7/17) or >108 Gy (other brain regions, 4/14). Doses to brainstem necrotic areas were >100 Gy. The time interval between previous courses and re-irradiation did not separate patients with and without brainstem necrosis treated to cumulative doses >105 Gy. Data suggested the risk of necrosis increased significantly when the cumulative dose exceeded 105 Gy to brainstem or 108 Gy to brain. Before other predictive factors are identified, radiation therapy plans should be designed to respect these constraints taking into account the competing risks associated with reduced target volume coverage.

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#7 *FSTL1 Expression in the Hematopoietic Hierarchy* ◙

Pramika Sriram; Trent Hall, Department of Experimental Hematology, St. Jude Children's Research Hospital; Shannon McKinney-Freeman, Department of Experimental Hematology, St. Jude Children's Research Hospital

Faculty Sponsor: William Eckenhoff, Department of Chemistry

Bone marrow transplants are actually the transplantation of hematopoietic stem cells (HSCs), which are able to self-renew and differentiate into all blood lineages. The ability of hematopoietic stem cells to effectively engraft and reconstitute ablated bone marrow is partially dependent on genetic factors. FSTL1 is a gene that is expressed in a variety of stem cell populations, including HSCs. In previous experiments, FSTL1 has been shown to be a negative genetic regulator of HSC engraftment and reconstitution. When FSTL1 is knocked down with shRNA, the ability of HSCs to engraft and reconstitute bone marrow in murine systems decreases. There was previously little data about FSTL1 expression levels in HSCs and downstream blood lineages. Through flow cytometry and RT-qPCR techniques, data has been collected to show that FSTL1 is most highly expressed in HSCs and other multipotent progenitor populations. FSTL1 is expressed at lower levels in downstream blood populations, such as the myeloid and lymphoid lineages. Additionally, it is critical to note that FSTL1 is a secreted glycoprotein; as such, there is potential to exogenously treat HSCs with FSTL1 prior to transplantation to increase engraftment and repopulating potential.

#8 *Characterizing the Phase Separation Potential of NUP98 Interactors for Co-localization within NUP98 Fusion Oncoprotein Cellular Puncta* ◙

Ramiz Somjee, Diana Mitrea, Richard Kriwacki

Faculty Sponsor: Terry Hill, Department of Biology

The NUP98 protein is mostly localized to the nuclear pore complex (NPC) where it helps form a permeability barrier to regulate nuclear transport. The formation of this barrier is driven by self-interactions between phenylalanine-glycine (FG) repeats within NUP98's N-terminal intrinsically disordered region. Through a mechanism termed phase separation, these self-interactions allow NUP98 to demix from the nucleoplasm and form the permeability barrier in the NPC. However, in many cases of pediatric acute myeloid leukemia (AML), the FG repeat domain of NUP98 is fused with the homeobox domain (responsible for binding to promoters of specific genes) of the HOXA9 protein. The resulting fusion protein, NUP98-HOXA9 (NHA9), forms nuclear puncta and re-programs gene expression. However, how these puncta alter gene expression is poorly understood. We hypothesize that, like NUP98 in the NPC, these puncta form through self-interactions of the FG repeats. A potential mechanism for gene-regulation is that transcriptional regulators are selectively incorporated into these puncta based on their ability to interact and phase separate with NHA9. To test this hypothesis, we searched the NUP98 interactome using sequence analysis algorithms to identify transcriptional regulators with the potential to undergo phase separation. From a list of about 35 phase separation-prone NUP98

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interactors, we selected 7 for experimental testing. We used turbidity assays to evaluate whether selected interactors phase separated in vitro. Finally, we probed if mechanisms of self-association were electrostatically or hydrophobically driven by assaying proteins in buffers of varying ionic strengths. Our results suggest that several transcriptional regulators known to interact with NUP98 can phase separate in vitro and potentially mis-regulate genes through co-localization within NHA9 puncta.

#9 *Innate immune stimulation may serve as a second hit in an osteochondroma mouse model* ◙
Emmaline Wittwer, Marie Wehenkel, Spencer Richardson, Maureen McGargill
Sponsor: Marie Wehenkel, St. Jude Children's Research Hospital
Hereditary multiple exostoses (HME) is a disease that presents multiple osteochondromas, which are benign cartilage-capped outgrowths of bone. The complete mechanism of tumor formation is unknown, although many, but not all, patients have mutations in either EXT1 or EXT2. Interestingly, Ext1+/- and Ext2+/- mutant mice are not a good model of HME, although double heterozygous Ext1+/-.Ext2+/- mice demonstrate higher tumor incidence. These findings suggest that Ext mutation alone is insufficient to drive the formation of multiple osteochondromas, so the field is now looking for a second hit model. Knowing that the immune system interacts with the skeletal system, we stimulated the innate immune system in Ext mice with the hypothesis that treated mice would present with enhanced osteochondroma incidence and/or severity. Using an asthma model, we found that treated Ext1+/- mice formed more, but smaller, tumors than control mice. Treating Ext1+/-.Ext2+/- mice with sequential adjuvant therapy significantly increased tumor incidence compared to untreated mice. These findings suggest that an immune response may be a sufficient second hit. Future studies will examine Ext mutant mesenchymal stem cells (MSC) compared to WT MSCs to test if mutation alone leads to altered differentiation or morphology and if inflammatory factors alter these indicators.

Biology 141

#10 *Are College Campus Squirrels More Accustomed to Human Interaction than Squirrels in a Natural Environment?*
Julianne L. Chung, Kelley, E. Parsons, Lauren K. Marotta, and Pranay Lingareddy
Faculty Sponsor: David Pike, Department of Biology

#11 *Cricket Growth Differences due to Food*
Peyton Clark, Chandler, Will France, and James Wright
Faculty Sponsor: David Pike, Department of Biology

#12 *The Effects of Acid Rain on Stomatal Aperture in* Brassica rapa
Demi Shamsi-Basha, Verina Sawiers, and Luis Alfaro

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Faculty Sponsor: David Pike, Department of Biology

#13 *Does habituation to pedestrian traffic affect the alert and flight response of Gray Squirrels (Sciurus carolinensis)?*
Gianna DeLuco, Jack Aldana-Proulx, Snow Perrin, and Sakshi Sawarkar
Faculty Sponsor: David Pike, Department of Biology

#14 *Effects of Water Acidity on* Brassica rapa *growth*
Tahliyah Mims, Wood Kimbrough, Julia Cronk, and Alex Smith
Faculty Sponsor: David Pike, Department of Biology

#15 *Differences in Density of Lichens on Oak Trees and Rocks*
John Wilkinson, Hunter Parrish, Kudzai Nyamkondiwa, and Trang Ho
Faculty Sponsor: David Pike, Department of Biology

#16 *Effects of salt concentration on vertical stem growth of fast plants (*Brassica rapa*)*
Olivia Barrett, Jaynee Patel, Rahul Sharma, Annie Wu
Faculty Sponsor: Stephanie Haddad, Department of Biology

#17 *The effects of reflective surfaces on substrate preference of male crayfish (*Procambarus clarkii*)*
Ryan Crump, Alex Lloyd, Susan Morris
Faculty Sponsor: Stephanie Haddad, Department of Biology

#18 *Does bark type affect the size of lichen colonies on trees?*
Annie Barber, Izzy Courtney, Jacob Greenberg, LaShonda Price
Faculty Sponsor: Stephanie Haddad, Department of Biology

#19 *The effects of car exhaust emissions on stomatal density of* Magnolia grandiflora
Kailey Pope, Emma Chow, Lexi Robertson, Richard Gentry
Faculty Sponsor: Stephanie Haddad, Department of Biology

#20 *Behavioral differences in Eastern Grey Squirrels (*Sciurus carolinensis*) in an urban vs rural setting*
Chinaza Nwokolo, Grace Oboh, Caroline Daly-Penny, Jason Singh
Faculty Sponsor: Stephanie Haddad, Department of Biology

#21 *Light preferences of the house cricket (Acheta domesticus) at night versus day*
Jemma Clary, Ava Mitra, Luigi Fusano, Julia Vining

Faculty Sponsor: Stephanie Haddad, Department of Biology

#22 *Effects of Air Pollution on Lichen Surface Area*
Michelle Adan-Pol, Kate McGough, and Caroline Yarbrough
Faculty Sponsor: Carolyn Jaslow, Department of Biology

#23 *The Effects of High Human Activity on Spinacia oleracea Stomatal Aperture*
Joseph Chopra, Deion Locklear, and Meagan Pittman
Faculty Sponsor: Carolyn Jaslow, Department of Biology

#24 *Effects of Different Concentrations of Gibberellic Acid on Fast Plant Growth*
Munazza Hussain, Maddie Chandler, and Kathleen Bochow
Faculty Sponsor: Carolyn Jaslow, Department of Biology

#25 *Temperature's Effects on Cricket's Location Preference in the Observation Tanks*
Payton Bennet, Grace Riley, and Priya Yelemali
Faculty Sponsor: Carolyn Jaslow, Department of Biology

#26 *The Effects of Resource Accessibility on Agonistic Behavior Between Female Crayfish*
Caroline Taylor, Nicole Luthcke, and Ryan Marasco
Faculty Sponsor: Carolyn Jaslow, Department of Biology

#27 *How Does Bark Texture Affect Lichen Density?*
C.J. Carron, Robert Boren, and Hannah Fort
Faculty Sponsor: Carolyn Jaslow, Department of Biology

#28 *Differentiation of Memphian Squirrel Foraging Distance Based on Amount of Foot Traffic on Campus*
Alexis McCall, Tillie Hilarides, and Noah Stewart
Faculty Sponsor: Carolyn Jaslow, Department of Biology

#29 *The Effect of Precipitation on Foraging Move Frequencies of American Robins (*Turdus migratorius*)*
Billy Clark, Nathan Meglic, and Heidi Frazier
Faculty Sponsor: Carolyn Jaslow, Department of Biology

#30 *Are squirrels living on the Rhodes Campus less afraid of humans than those living in Overton Park?*
Henry Alsobrook, Emma Cook, and Lauren Hodges

Faculty Sponsor: Robert Laport, Department of Biology

#31 *Does substrate affect lichen size?*
Izzy Gillespie, Olivia House, and Mackenzie Sawyer
Faculty Sponsor: Robert Laport, Department of Biology

#32 *The effect of gender on dominance in crayfish*
Ana Trpchevska, Chiarra Milo, and Summer Scott
Faculty Sponsor: Robert Laport, Department of Biology

#33 *Are squirrels attracted to trash cans at certain times of the day?*
Kaitlin Gasner, Ayanna Kemp, Barrett Leonhard, and Abby Sweeney
Faculty Sponsor: Robert Laport, Department of Biology

#34 *What is the stomatal aperture of magnolia leaves during the day compared to when the sun is setting?*
Maggie Gibbons, Tabitha McCarty, and Megan Rainey
Faculty Sponsor: Robert Laport, Department of Biology

#35 *Which species of tree, oak, magnolia, or pine, do grey squirrels (*Sciurus carolinensis*) prefer to nest in on the campus of Rhodes College?*
Lauren Martin, Sophie Enda, and Emaan Khawaja
Faculty Sponsor: Robert Laport, Department of Biology

#36 *Do female crayfish prefer a certain color substrate due to the photoreceptors in their eyes?*
Liam Rhodes, Elizabeth Greebon, Sydney Watts
Faculty Sponsor: Robert Laport, Department of Biology

#37 *How does varied light exposure affect growth rate of fast plants?*
Nicole Falodun, Jessica Gonzalez, Braxton Jeffcoat, Arrington Moses
Faculty Sponsor: Michael Collins, Department of Biology

#38 *Eastern Gray Squirrel's (*Sciurus carolinensi*) Perceptions of Humans*
Ansam Qaddoumi, Peter Bahouth, Parisa Poorfard
Faculty Sponsor: Michael Collins, Department of Biology

#39 *Effects of Chelae Size on Crayfish Dominance*
Emily Blaum, Johane Boff, Sarah Schweitzer
Faculty Sponsor: Michael Collins, Department of Biology

#40 *Sciurus carolinensis flush distance difference between a single person, two people and a single person with a dog*
Rachel Ancar, Chloe Christion, Rita Johnson
Faculty Sponsor: Michael Collins, Department of Biology

#41 *Effects of variations of visible light On Fast Plants*
Yash Singh, Aby Binu, Chester Ngien
Faculty Sponsor: Michael Collins, Department of Biology

#42 *Fast plant (terrestrial) growth*
Christian Cisneros, Kobe Bins, Mark Minogue
Faculty Sponsor: Michael Collins, Department of Biology

#43 *How does squirrel foraging activity vary with changing temperature during the day?*
Yahya Hameed, Brandon James, Grace Lovett
Faculty Sponsor: Michael Collins, Department of Biology

#44 *Does stomatal density differ between plants classified as monocotyledons and dicotyledons?*
Dallas Bennett, Veronica Houle, Cat Snyders
Faculty Sponsor: Michael Collins, Department of Biology

#45 *Bud Distribution in Colonies of* Asimina triloba
Madeline Kennell, Pramika Sriram, and Natalie Thomas
Faculty Sponsor: Sarah Boyle, Department of Biology

#46 *Effect of Tannin Levels on Grey Squirrels' Acorn Preference*
Jadesse Chan, Pooja Shah, and Gary Wigman
Faculty Sponsor: Sarah Boyle, Department of Biology

#47 *Predation Differences in Urban and Wildlife Environments*
Jordan McCoy, Bitia Alanis, and Sona Vaghela
Faculty Sponsor: Sarah Boyle, Department of Biology

#48 *Is Water from the Mississippi River in Memphis or Rainbow Lake More Conducive to the Growth Rate of Lemna minor, the Common Aquatic Duckweed?*
Kai Taylor, Mira Greenberg, and Rohan Kaza
Faculty Sponsor: Sarah Boyle, Department of Biology

#49 *Do Crayfish Prefer Fresh or Brackish Water?*
Mary Catherine Marsden, Cameron Cluney, and Tre' Barnes
Faculty Sponsor: Sarah Boyle, Department of Biology

#50 *Do Crickets Have a Preference for Blue Light?*
Christopher Prigg, Gwyneth McMahon, and Andy Schild
Faculty Sponsor: Sarah Boyle, Department of Biology

#51 *Influence of Tree Proximity on Grass Coloration*
Kennedi Fitts, Oleg Rouvinski Vasilieva, and Dasha Safarian
Faculty Sponsor: Sarah Boyle, Department of Biology

#52 *Effect of Different Sound Frequencies on Squirrels*
Amber Toler, Sofia Bayuelo, and Gillian Winston
Faculty Sponsor: Sarah Boyle, Department of Biology

#53 *Effects of the Presence of a Predator on the Behavior of Squirrels in Different Locations*
Stephan Jean-Francois, Nadia Hyatt, Thomas Powell, Genevieve Tuznik
Faculty Sponsor: Patrick Kelly, Department of Biology

#54 *Effect of Different Wavelengths of Light on Stem Height of Fast Growing Terrestrial Plants*
Campbell Brown, Steven Mysiewicz, Alisha Pershad
Faculty Sponsor: Patrick Kelly, Department of Biology

#55 *Do Squirrels Reduce their Anti-Predatory Responses when they become desensitized to their Predators?*
Nikita Moosani, Georgia Gillenwater, Ricardo Coss, Emma Root
Faculty Sponsor: Patrick Kelly, Department of Biology

#56 *What are the Food Source Preferences of Crickets?*
Reis Chehardy, Riya Patel, Margaret Johnson
Faculty Sponsor: Patrick Kelly, Department of Biology

#57 *The Effect Human Approach has on Instinctive Responses on Eastern Gray Squirrels (*Sciurus carolinensis*)*
Berkeley Barnett, Candelaria Willoughby
Faculty Sponsor: Patrick Kelly, Department of Biology

#58 *Does the Presence of Vegetation Alter the Substrate Preference of Crayfish?*

Shreya Visvanathan, Eleanor Fontana, Patrick Crain
Faculty Sponsor: Patrick Kelly, Department of Biology

#59 *Does the location of a tree determine the size of the lichen which grows upon it?*
Jared Briant, Audrey DeLeuil, Sujung Hwang
Faculty Sponsor: Patrick Kelly, Department of Biology

#60 *Effects of Various Wavelengths of Light on the Growth of Duckweed*
Ubaid Tanveer, Alisya Solankhi, Kellen Whalum
Faculty Sponsor: Patrick Kelly, Department of Biology

Sciences

#61 *Interactions Between Captive Waterfowl in the Tropical Birdhouse*
Bill Hague, Peter Dorn
Faculty Sponsor: Sarah Boyle, Department of Biology
Dabbling duck interactions in the wild are frequently related to competition over food resources. Due to the increasing importance of mixed species exhibits and assessing animal welfare, it is necessary to quantify the impact of interactive behavior on dabbling duck activity budgets. Specifically, in the Memphis Zoo, ringed teals interactively dominate African pygmy geese. However, in captivity, interactions between these dabbling ducks only affect specific aspects of behavior and location. Interactions do not impact African pygmy goose behavior nor do interactions increase the distance between the two species. In contrast, specific ringed teal active behaviors (walking and drinking) are more frequent after interactions. Due to complications with food distribution amongst different parts of the exhibit, we were unable to assess whether or not food impacted differences in location or behavior. With more sampling at different hours of the day, zookeepers may find our research essential to avian welfare in Memphis Zoo's tropical birdhouse.

#62 *The Effects of Memphis Temperatures on Captive African Elephants (*Loxodonta africana*)* ◙
Hannah Lam
Faculty Sponsor: Sarah Boyle, Department of Biology
Wild African elephants are accustomed to the seasonal temperature changes of Northern, Southern, and Eastern Africa. Captive African elephants are placed into various climates that they may not be innately adjusted to. The activity levels of captive individuals often correlate to the animal's health. A good health record is also a major indicator of individuals that are viable for captive breeding programs. Behavioral scans were conducted throughout a course of one year to monitor changes in activity during seasonal changes. I hypothesized temperature has an effect on activity levels. I predicted that as temperatures reached levels outside of the native range, the

◙ Rhodes Fellowship

number of active behaviors would decrease. The findings of my analysis are important for understanding if captive individuals have been placed in climates that are ideal for the overall wellness of the animals and the health of the captive population in the future.

#63 *Floristic Survey of "The Cut" Section of the Vollintine & Evergreen Greenline*
Ellinor Aronson, Zoe Brookover, Caroline Bush, Erin Dempsey, Kunyuan Li, J. Michael Phebus, Russell Sands, and Deja Walls; Robert Laport, Department of Biology
Faculty Sponsor: Robert Laport, Department of Biology
Urban green spaces provide opportunities for community recreation, as well as crucial habitat for many native plant and animal species living within an urban matrix. Though many of these urban green spaces are planned, others have been converted from formerly industrial or other intensive-use lands. Greenlines, which are green spaces converted from former urban rail lines, are increasingly common in cities across the US. Despite the increased prominence of greenlines, their potential ecosystem services remain unclear as the species present within these spaces remain poorly documented. The Vollintine & Evergreen (V&E) Greenline, adjacent to the northern edge of the Rhodes College campus, provides recreation space to members of the community. Prior to 1980, the V & E Greenline was an active railroad and was an abandoned green space before the establishment of the formal greenline in 1996. Though the V&E Greenline represents important urban habitat for many native plant species, it remains unclear how the industrial history and period of neglect may have influenced invasive or non-native species establishment. Here we report on our efforts to survey plant species within "The Cut" section of the V&E Greenline, extending from University St. to McLean Blvd. We find that "The Cut" harbors many native species, representing important resources for native birds and mammals, but the Greenline also harbors non-native and known invasive species. The presence of non-native species should be further evaluated, given the proximity of the V&E Greenline to the relatively undisturbed Overton Park Old Forest.

#64 *DFT analysis of water clusters, dopaminergic derivatives, and their desolvation energies*
Emily Sanders, Mallory Morris, Larryn Peterson and Mauricio Cafiero, Department of Chemistry
Faculty Sponsor: Mauricio Cafiero, Department of Chemistry
Our current research explores the synthesis, metabolism, and excretion of novel catecholamines which could serve as drugs in the dopaminergic pathway. By studying all of the enzymes involved in the dopaminergic pathway, we can paint a comprehensive picture of how these catecholamines will behave in our bodies which will help us find novel drugs that could treat conditions such as Parkinson's disease. Computational models of dopaminergic analogs were used to examine the substrates' binding in the enzymatic active site. The binding of a ligand to an enzyme not only involves the interaction between the ligand and the enzyme but also the energy lost or gained by desolvation of the ligand. Desolvation of dopaminergic derivatives was

examined using a series of hydration shells that increase in size and was examined using many different suites of ligands. The desolvation energies were calculated using M062X with the aug-cc-pvdz, cc-pvdz, and cc-pvtz basis sets. Ligands with amine group in the sixth positon of the ring exhibited the least favorable energies, whereas neutral ligands exhibited the most favorable desolvation energies in the explicit water model. This information will be combined with prior research done on ligand/enzyme interaction in order to get a more comprehensive understanding of ligand binding in this system.

#65 *Predicting the Future: NCAA March Madness Basketball*
Jacob Sutton, William Raines, Liam Nolan
Faculty Sponsor: Catherine Welsh, Department of Mathematics and Computer Science
There is a 1 in 9,223,372,036,854,777,808 chance of filling out a perfect NCAA March Madness bracket. This makes it statistically impossible for a human being to correctly pick the winner of each game. Our group was not content with this realization. Through the process of machine learning, we believe we have come up with a method to do the impossible. We collected data for every game and game statistic recorded during the 2019-2020 NCAA Division 1 College Basketball regular season. We then took all of this information and applied it to a machine-learning algorithm. This algorithm took each team's performance in each game and quantified it, allowing us to compare the expected performance of each team in any game, and make an educated prediction on who will win. Preliminary testing on last season's data concluded that at worst we'll correctly choose the winner of each game in the bracket 73% of the time. However, we expect our accuracy to be above 80%. The tournament runs from March 19th - April 8th, after which we will know how well we did.

#66 *Irrelevant ensemble information may successfully be ignored… sometimes*
Delaney McDonagh; Jason Haberman, Department of Psychology
Faculty Sponsor: Jason Haberman, Department of Psychology
Ensemble perception allows us to rapidly derive summary statistical information from groups of similar objects. Ensembles are generated so quickly and efficiently that some researchers hypothesize that they can help guide visual search. If ensembles leak through the limits imposed by the attentional bottleneck, is it possible to filter irrelevant ensemble information? In the current study, we examined whether observers could selectively ignore similar but irrelevant ensemble information. In a series of experiments, observers viewed multiple sets of gabors, presented simultaneously, and had to report the average orientation of just one of the sets, post-cued, using method-of-adjustment. The sets of gabors were either two sets of four gabors (two ensembles), or a set of four gabors presented with an additional individual gabor. Arrangement of the gabor sets and cueing procedures varied across experiments. The average of the irrelevant set of gabors was oriented 45° away from the average of the cued set, and could feasibly be incorporated into an average representation. The results revealed that the number of trials in

which observers' average orientation responses were drawn in the direction of the irrelevant set was not different from chance. However, the magnitude of the pull on trials in which they were pulled toward the irrelevant set was significantly greater when the irrelevant set contained an ensemble as opposed to an individual. Interestingly, even on trials in which the response went in the unpredicted direction, the magnitude of deviation was smaller when the irrelevant stimulus was an ensemble, suggesting its presence kept observers more anchored. The overall pattern of these results was still present, albeit mitigated, when observers were pre-cued. We conclude that an irrelevant ensemble can be successfully ignored, but when observers fail in doing so the ensemble wields a larger influence than an individual item.

#67 *Electrostatic Potential Graphs to Design Prohibitors in Dopamine Pathway*

Spring Smith

Faculty Sponsor: Mauricio Cafiero, Department of Chemistry

Parkinson's Disease (PD) arises from a lack of dopamine in the brain. Various enzymes may inhibit or aid the production of dopamine. Monoamine Oxidase B inhibits the activity of dopamine by oxidation (coverting a CH2NH3+ group to a carbonyl group). By inhibiting this enzyme, the oxidation of dopamine would decrease yielding higher dopamine levels. Tyrosinase also decreases the amount of available dopamine by oxidizing L-DOPA (a dopamine pre-cursor). Inhibition of this enzyme would decrease the oxidation of L-DOPA, generating an increase of dopamine. Tyrosine hydroxylase aids in the production of dopamine by converting tyrosine to L-DOPA. In order to determine novel PD treatments to increase dopamine, electrostatic potential maps (M062X) of potential inhibitors for these three enzymes were compared to interaction energies calculated using M062X and M06L. Looking at these maps, the electron distributions are most favorable for predicting interaction energies in Monoamine Oxidase B.

#68 *Individuals with low other race effect employ a global eye movement strategy when recognizing other race faces*

Yavin Alwis

Faculty Sponsor: Jason Haberman, Department of Psychology

The Other Race Effect (ORE) is a well-established phenomenon in which individuals better recognize and recall same-race faces over other-race faces. Both sociocognitive and perceptual theories have been proposed to explain the mechanisms of the ORE. One recent perceptual theory involves the face-space model, in which differences in featural processing strategies exist depending on the race of the face being viewed. Specific processing strategies may be revealed by monitoring an individual's eye movements while viewing a face. While different-race faces may be more effectively identified by employing race specific eye movement patterns, observers who demonstrate a strong ORE are non-optimal in their deployment strategies, and instead reveal similar eye movement patterns across different races. The current experiments used an individual differences approach to explore whether individuals who demonstrate a reduced ORE deploy

race specific eye movements (what one might predict as optimal), or whether they use a more generalized, global strategy. To determine the extent of one's ORE, participants completed a face learning and recognition task using faces across three races. Eyetracking was used during the recognition task to measure eye deployment patterns and first fixation locations. Overall, eye movement patterns elicited by individuals with low ORE were highly consistent across the three races. This suggests that, although there are optimal recognition strategies specific to different-race faces, low ORE participants did not necessarily rely upon them. Despite this, their performance in recognizing other-race faces remained as good as it was for their own-race faces. These results suggest that low ORE participants employ a more global strategy when viewing other-race faces.

#69 *An attentional blink for ensemble representations*

Sneha Suresh, John W. Roberts; Jason Haberman, Department of Psychology
Faculty Sponsor: Jason Haberman, Department of Psychology

The visual system averages similar features in our environment in a process known as ensemble perception. Evidence suggests ensemble perception effectively operates even with limited attention, providing visual stability in a dynamic visual environment. Such findings raise the possibility that ensembles are robust to the attentional blink, a paradigm in which observers are unable to detect a second target in an RSVP stream after detection of a different, first target. In the current experiments, we explored whether ensemble representations are subject to an attentional blink. In our paradigm, observers viewed rapidly presented, cross-hatched patches, created by overlapping two orthogonally oriented gabors. Observers first had to detect a particular feature (T1), which varied across experiments (e.g., vertical or horizontal, red or blue, high or low spatial frequency), after which they had to adjust a test stimulus to match the average of the preceding set (either orientation or color; T2). The time between T1 and T2 varied. Adjustment performance improved at 1800 ms, but only when T1 and T2 came from different visual domains, suggesting that it is possible to partially blink ensemble information. When the T1 judgment came from the same visual domain as T2, performance on the averaging task was consistently worse than when T1 came from a different domain, and did not vary as a function of ISI. Overall, these results suggest that, even though ensembles are extracted efficiently from the visual environment, they are nonetheless dependent on the availability of attentional resources.

#70 *Experimental and Computational Investigation of the Solvatochromism of [Mo(diimine)Cl4]- Compounds*

Sarah Helland
Faculty Sponsor: William Eckenhoff, Department of Chemistry

A solvatochromic compound is a chemical compound that changes its color based on solvent polarity. We found that the [Mo(bpy)Cl4]- anion is highly solvatochromic over a wide range of solvents. From water to acetone, the absorbance maximum shifts over 100 nm with a

corresponding color change of yellow to blue, respectively. To expand upon this, we investigated other ligand architectures that might show similar solvatochromic behavior. Specifically, we examined 1,10-phenanthroline (phen), and the mono- and bimetallic 2,3-bis(2-pyridyl)pyrazine (bppz). Monometallic complexes with these ligands showed only slight changes in their solvatochromism range, while bimetallic complexes of bppz showed markedly different characteristics. In the case of [Mo2(bppz)Cl8]2-, the absorbance red-shifted ~50 nm, producing a range of green colors. In addition, this compound clearly showed four distinct redox couples, compared to the monometallic compounds with only two redox couples. The [Mo(bpy)Cl4]- anion was computationally investigated to better understand the nature of this interesting property, and this computational analysis of the phen and bppz anions will be compared to continuing experimental data.

#71 *Exploration of ordering effects in psychophysical assessments*

Noah Mesa

Faculty Sponsor: Daniel Blustein, Department of Psychology and Neuroscience

Individuals with prosthetic limbs often reject their prosthesis because they feel that their mechanical limb is not their own. Scientists are remedying this discrepancy by helping individuals embody the new limb by providing feedback. One quantitative metric of embodiment is the cross model congruency effect (CCE) score, which measures the degree of incorporation of a prosthetic system into one's body schema. This visual-tactile interference task has shown that congruent visual and tactile feedback results in faster reaction times than incongruently-presented feedback. Order effects during the random allocation of congruent and incongruent trials during the CCE task may bias the CCE score resulting in a congruency sequence effect. Using data from previous experiments, we conducted a trial-by-trial analysis using a mixed effects model to show the impact that trial order has on CCE scores. We explore whether a described task learning effect might be explained by a repetition expectancy that is continually recalibrated as task exposure increases. Additionally, we extend this analysis protocol to other psychophysical tasks to see if similar mechanisms are at play. The conducted statistical tests show the limitations and strengths of the current psychophysical protocols which can inform their use in clinical settings.

#72 *Matrix Demographic Models to Understand Life History Strategies Using Stage-Structured Matrix Models to Understand Demographic Impact of Life History Strategies in Florida Tillandsia*

Zoe Brookover, Ali Campbell, Brian Christman, Sydney Davis

Erin Bodine, Department of Mathematics and Computer Science

Bromeliads are a family of flowering plants native to subtropical America that grow in the form of rosettes. A bromeliad reproduces sexually by generating an inflorescence, typically from the center of a rosette of vegetative leaves, with many flowers each of which produce seeds when

pollinated. An iteroparous bromeliad has multiple opportunities to sexually reproduce via the production of clonal rosettes, while a semelparous bromeliad have one opportunity to sexually reproduce. These two types of bromeliads face conservation challenges due to their different reproductive strategies. We will be focusing on the iteroparous Tillandsia fasciculata and the semelparous Tillandsia utriculata. These two populations are imperiled by an invasive weevil, Metamasius callizona. The weevil larvae consume much of the leaf base and meristematic tissue, causing significant damage and the eventual death of the plant. Due to its inability to regenerate from undamaged axillary meristems, T. fasciculata has shifted induction to occur at a smaller rosette sizes, which impacts the number of seeds produced. This stage-structured matrix model projects the effects a shift toward earlier induction of smaller rosettes on the population dynamics of T. fasciculata. Additional work will be done to model population dynamics of T. utriculata.

#73 *Using Matrix Models to Predict Long-Term Population Dynamics of Two Tree Species*
Colleen Hulsey; Erin Bodine, Department of Mathematics and Computer Science
Faculty Sponsor: Erin Bodine, Department of Mathematics and Computer Science
Native tree species serve important ecological and economic roles, but they're threatened by environmental disturbance including competition with invasive species. Sugar maple (Acer saccharum) is a native tree in Tennessee, important for its lumber, sap, and pollution control. Tree-of-heaven (Ailanthus altissima) is an invasive species in Tennessee, characterized by its rapid growth which chokes out native species. I used matrix models to examine their population growth rate, stable population structures, and sensitivity at different age classes. I also examined the range of these outputs given uncertainty in the parameters.

#74 *Functional Neurologic Symptom Disorders Present an Excessive Burden on Healthcare Resources*
Mallika Rao; Jack R., McCoy E., Ledet D., Le Bonheur Children's Hospital
Faculty Sponsor: Kelly Dougherty, Department of Biology
Patients that present with Functional Neurologic Symptom Disorder (FND) pose a large burden on the health care system due to extensive use of healthcare resources. The length of a patient's stay was used as a measure of minimal resource use during hospital stay. This study is a single center, retrospective review of 102 patients, age 8-18, who presented with FND, filed under the ICD-9 Code R300.1 and the ICD-10 Code F44.5, between the years of 2015-2017. Out of 102 patients (77 females, 28 males, mean age: 14.58 years, and mean length of hospital stay: 31.706 hours) patients presented mostly with either seizure-like episodes (n=63), syncopal episodes (n=14), or limb weakness/paralysis (n=9). Length of stay was likely to be shortest in patients that presented with seizure-like episodes (P= 0.040). Most children who presented with FND were females and presented with seizure-like symptoms. Patients with such symptoms were more likely to have a shorter hospital course. The length of hospital stays had a wide standard

deviation due area in which the patients were evaluated, epilepsy monitoring unit versus emergency department. This study depicts a greater need for development of protocols to be used in the evaluation and management of patients with FND. The data review indicated that a majority of patients (73.53%) returned to the hospital due to the lack of adequate follow up care. Further investigation in this area is needed in order to facilitate development of such protocols and to address the need for adequate follow up care.

#75 *Characterizing the Phase Separation Potential of NUP98 Interactors for Co-localization within NUP98 Fusion Oncoprotein Cellular Puncta*

Ramiz Somjee, Diana Mitrea, Richard Kriwacki
Faculty Sponsor: Terry Hill, Department of Biology

The NUP98 protein is mostly localized to the nuclear pore complex (NPC) where it helps form a permeability barrier to regulate nuclear transport. The formation of this barrier is driven by self-interactions between phenylalanine-glycine (FG) repeats within NUP98's N-terminal intrinsically disordered region. Through a mechanism termed phase separation, these self-interactions allow NUP98 to demix from the nucleoplasm and form the permeability barrier in the NPC. However, in many cases of pediatric acute myeloid leukemia (AML), the FG repeat domain of NUP98 is fused with the homeobox domain (responsible for binding to promoters of specific genes) of the HOXA9 protein. The resulting fusion protein, NUP98-HOXA9 (NHA9), forms nuclear puncta and re-programs gene expression. However, how these puncta alter gene expression is poorly understood. We hypothesize that, like NUP98 in the NPC, these puncta form through self-interactions of the FG repeats. A potential mechanism for gene-regulation is that transcriptional regulators are selectively incorporated into these puncta based on their ability to interact and phase separate with NHA9. To test this hypothesis, we searched the NUP98 interactome using sequence analysis algorithms to identify transcriptional regulators with the potential to undergo phase separation. From a list of about 35 phase separation-prone NUP98 interactors, we selected 7 for experimental testing. We used turbidity assays to evaluate whether selected interactors phase separated in vitro. Finally, we probed if mechanisms of self-association were electrostatically or hydrophobically driven by assaying proteins in buffers of varying ionic strengths. Our results suggest that several transcriptional regulators known to interact with NUP98 can phase separate in vitro and potentially mis-regulate genes through co-localization within NHA9 puncta.

#76 *Development of Epitope Binding Protein Monobodies as an Antigen Specific Treatment for Autoimmune Disease*

Omar Stocks
Faculty Sponsor: Shana Stoddard, Department of Chemistry

Autoimmune disease (AD) is a disease where antibodies incorrectly attack healthy self cells by binding to antigens. As a result of this self attacking, patients experience long term sickness or

even death. Current treatment methods include the use of non-specific immunosuppressive medicines, which are somewhat effective at diminishing the effects of the disease, but leave the patient with a significantly weakened immune system and decreased ability to fight off simple pathogens. This emphasizes the need for a more specific treatment for autoimmune disease. The work here focuses on the disease primary membranous nephropathy (PMN), which targets three domains of the phospholipase A2 receptor (PLA2R): the ricin domain and C-type lectin domains numbers 1 and 7 (CTLD1 and CTLD7). The goal of this project is design of antigen specific treatment for PMN, which involves hiding domains of the PLA2R antigen from the antibodies by identifying the epitope sites where the antibodies wish to bind through design of protein monobodies. In this work the epitope regions on CTLD7 were predicted using the programs Epitopia and EPCES. The data suggest that there are three distinct epitope locations on CTLD7, which could be targeted by PMN autoantibodies. Currently, 26 epitope caps have been designed using the templates 3UYO and 5A40. Our results show that in silico mutagenesis of protein monobodies enhanced binding of epitope caps to the epitope sites from -4.94 Rosetta Energy Units (REU) on the 3UYO template to -5.094 REU in 3UYO-004-OS and -5.081 on 3UYO-022-OS. The 5A40-001-OS cap improved binding to -7.596 REU from -5.618 in the 5A40 template. Results indicate that in the 5A40-001-OS cap, introduction of a negatively charged aspartate created an electrostatic interaction with CTLD7, which improved the potency of binding. The 5A40-001-OS cap along with 3UYO-004-OS and 3UYO-022-OS caps will be selected for expression in E. coli and tested with ELISA assays. The results of this work could lead to a much safer and more antigen specific treatment for autoimmune disease.

Social Sciences

#77 *Retaining Healthcare Employees*

Andrew Murphy

Faculty Sponsor: Dee Birnbaum, Department of Business

Nationwide, there are not enough nurses to meet current demand. High job burnout along with low nursing school attendance and graduation rates continually contribute to the nursing shortage. These issues must be dealt with so that the discrepancy between supply and demand does not increase for perpetuity. Interviews, questionnaire data, and archival information were used to obtain insights into the motivations of those pursuing a career in nursing. Additionally, information regarding the participants' backgrounds and the daily tasks they execute was collected. The data will provide a deeper understanding of the motivating factors that drive successful nurses and reveal the tasks that hold the most importance amongst those in the nursing community.

#78 *Effects of NPC Sorority Membership and Involvement on Grade Point Averages*

Carly Cone, Carlyn Shockley, Melissa Kiker, Megan Jackson

Faculty Sponsor: Dee Birnbaum, Department of Business

We examined whether women who are involved in Greek organizations have higher GPAs than women not involved in Greek organizations at Rhodes College. To our knowledge, no prior studies have been performed exploring the GPA's of women in the Rhodes population in connection to their Greek organization involvement, despite Rhodes commitment to academic excellence and the fact that over 54% of Rhodes female population participates in sororities. We surveyed female students at Rhodes to study involvement, structure, accountability, and time management. Using the archival GPA data provided by the college, we were able to sample 1,113 females, the entirety of the female population at Rhodes. From our personal investment in these organizations, we hypothesized that women involved in Greek organizations would have higher GPAs than women not involved in Greek organizations because of factors including increased involvement, more structure, higher accountability, and efficient time management.

#79 *Investigating the Spacing Effect in Real and Synthesized Vocal Rhythms*

Eraine Leland

Faculty Sponsor: Geoffrey Maddox, Department of Psychology

This study was conducted to analyze the impact of lag on memory of rhythms presented in a vocal timbre. Existing research describes the spacing effect as an underlying mechanism of memory in which long term memory benefits from studying material across spaced sessions rather than all at once. Research by Weiss, Trehub, and Schellenberg (2012) has shown that human voice is more memorable than other timbres. Therefore this study specifically studies recognition of rhythms that were recorded in a human or synthesized voice. Participants completed a total of twelve trials, in which they listened to a short musical piece composed of different rhythms recorded in a human or synthesized voice. After each trial, participants were given a recognition test measuring memory of target rhythms that had been repeated at various lags (0, 3, and 9). It was hypothesized that the repeated rhythms presented in human voices would be remembered more easily than the rhythms presented in other timbres. It was also predicted that rhythms that were presented in a spaced fashion rather than consecutively would be better remembered. Finally, we anticipated that the spacing effect would be stronger for rhythms recorded in a human voice than a synthesized voice.

#80 *Studying the Spacing Effect with Melodic Motifs*

Julia Vick

Faculty Sponsor: Geoffrey Maddox, Department of Psychology

The current study examined the spacing effect (i.e., the benefit in memory for material that is repeatedly studied with intervening time or material compared to repeated study events that occur consecutively; see Maddox 2016 for a review) through repetition of melodic motifs in short passages of piano music. In each trial, participants listened to a short musical passage with multiple, repeated motifs that were separated by varying amounts of spacing. With regard to

music, melodic motifs shared the same contour or had distinct contours across levels of the spacing manipulation. It was predicted that memory performance would be better for trials in which melodic motifs had similar contour compared to trials in which melodic motifs had different contour. Further, it was predicted that memory would be better for motifs that were repeated following longer lags compared to shorter lags. Finally, we predicted that there would be no significant interaction between the variables.

#81 *The Impact of Encoding Variability on the Spacing Effect in Music*

Ellen Brooks

Faculty Sponsor: Geoffrey Maddox, Department of Psychology

The spacing effect refers to the finding that separating repeated study events across time or with intervening material typically leads to enhanced memory compared to massed study events (see Maddox 2016 for a review). Encoding variability can possibly account for the spacing effect as it increases the number of routes of retrieval for a target stimulus (e.g., Melton, 1970). We predicted that varying timbre (i.e., the sound quality) across repetitions of musical rhythm would increase encoding variability compared to using the same timbre across repetitions. Across two conditions participants listened to short musical passages in which repeated rhythms were separated by one of three different spacing intervals. Additionally, repetitions were presented in either constant timbre (e.g., wood block on both presentations) or varied timbre (e.g., wood block on presentation 1 and triangle on presentation 2). After listening to each musical passage, participants completed a recognition task for the repeated rhythms and similar-sounding lures. We predicted that the spacing effect would be reduced in the variable condition compared to the constant encoding condition, indicating that encoding variability increases participant's ability to remember stimuli.

#82 *Taboo Congruency Sequence and Carryover Effects Influence Speech Production*

Sabine Lohmar

Faculty Sponsor: Katherine White, Department of Psychology

Research has demonstrated a role for cognitive control in the regulation of emotional distraction during speech production. The present study investigated whether control adjustments occur between trials by testing for (a) congruency sequence effects (CSEs) and (b) carryover effects on consecutive trials of a picture-word interference task. Two experiments varied the distractor's congruency (congruent = identical to the target, incongruent = different from the target) and emotion (taboo, neutral), as well as the location of the incongruent-taboo trial as first or second. Experiment 1 found a taboo CSE, as naming incongruent-taboo trials was faster if the previous neutral trial was incongruent compared to congruent. However, emotion modified the benefit of a previous incongruent trial, with incongruent-taboo trials named faster if the previous incongruent trial was taboo compared to neutral. Experiment 2 found taboo carryover effects that sped naming of the subsequent trial: Incongruent-taboo trials had the largest carryover on

congruent-neutral trials and smallest carryover on incongruent-taboo trials. These findings help define a role for trial-to-trial adjustments in controlling emotional interference when producing language.

#83 *Using the Shifting Standards Model to Explain Race-Based Compensation Decisions*
Annie Nottingham
Faculty Sponsor: Matthew Weeks, Department of Psychology
The shifting standards model provides a framework for considering interpersonal judgments for which a stereotype exists. The SSM suggests that standards used in stereotypic judgments differ for relevant groups, with judgments influenced by relative within-group criteria. A race by status confound or stereotype exists, where white people are associated with high SES and black people are associated with low SES. In an effort to explain racial wage gaps, the SSM has been applied to workplace compensation decisions. Results of an online survey showed that when randomly presented either a white or black employee, the raise awarded to the white employee was higher than that given to the black employee, while the rating of the black employee's raise was slightly higher than the white employee's raise. A conceptual replication of this study was recently conducted, but instead of being assigned to evaluate either the white or black employee, the participant had to choose to hire either the white or black employee and subsequently assign them a salary, objective measure, and a rating of that salary subjective measure. In this study, while the interaction of type of judgement (objective vs. subjective) and target category (employee's race) was not statistically significant, the pattern of white participants rating the black employee's salary as subjectively better than the employee's was still present. Also, the degree to which the white participant shifted standards on their judgment differed based on the individual's level of racial prejudice.

#84 *Perceived life stress enhances the association between negative affect and snacking under stress*
Tzvi Nadel
Faculty Sponsor: Rebecca Klatzkin, Department of Psychology
Perceived life stress (PLS) and cognitive restraint are associated with increased comfort food intake under stress, but the mechanisms remain unclear. Stress and negative affect (NA) are associated with increased comfort food intake as a means to 'feel better', particularly for individuals with PLS and cognitive restraint. Consequently, we propose that PLS and cognitive restraint enhance the ability of stress-induced NA to predict greater comfort food intake. Upon comfort eating, PLS has been associated with greater reductions in the deleterious consequences of stress (e.g. cortisol and NA). Thus, for women with PLS, greater emotional relief upon stress-eating may act as negative reinforcement that drives the hyperphagic effects of stress-induced NA. We hypothesize that 1) PLS and cognitive restraint will strengthen the ability of stress-induced NA to drive increased snack intake, and 2) greater PLS will be associated with greater

reductions in NA upon snacking under stress. 43 women were given snacks after a stress or rest period in counterbalanced order. We determined that PLS enhanced the impact of stress-induced NA on greater snack intake under stress ($\beta = .072$, $p = .036$). PLS also predicted greater emotional relief upon snacking under stress ($\beta = .024$, $p = .032$). For women with PLS, greater reductions in NA upon stress-eating may reinforce the relationship between stress-induced NA and snack intake. This hypothetical conditioning effect may help to explain greater rates of obesity in this population, but this needs to be directly examined in future studies.

POSTER SESSION II

Multi-Sports Forum in the Bryan Campus Life Center
4:00-6:00 pm
Poster numbers are listed with each title.

St. Jude Summer Plus Fellowships

#1 *Upregulated DBX1 in a murine model of ERMS and human ARMS patients suggests a common link in RMS tumorigenesis* ◙
Kristin Reed; Casey G. Langdon, Department of Oncology, St. Jude Children's Research Hospital; Johnathan Dallman, Kansas State University; Mark E. Hatley, Department of Oncology, St. Jude Children's Research Hospital
Faculty Sponsor: Michael Collins, Department of Biology
Rhabdomyosarcoma (RMS) is the most prevalent childhood soft tissue sarcoma, making up 50% of these tumors. RMS is divided into four categories: embryonal RMS (ERMS), pleomorphic RMS, spindle cell RMS, and alveolar RMS (ARMS). Patients with ARMS are most likely to present with metastasis and have the worst prognoses, especially compared to patients with ERMS, the most common subtype. Patient survival has not improved over the past 30 years, with requisite aggressive treatment often increasing the risk that children will develop additional malignancies later in life and/or experience significant co-morbidities, including disfiguring surgery. Future research into the molecular mechanisms responsible for RMS tumorigenesis aims to improve treatments and clinical outcomes. To better understand the origins of RMS, our laboratory developed a highly penetrant, early onset, Hedgehog-driven ERMS model. Loss of PTEN expression is seen in 90% of ERMS patients, suggesting an important role for the gene in RMS tumorigenesis. Our mouse model has been further augmented by the genetic deletion of the Pten tumor suppressor, resulting in tumors more closely resembling those seen in ERMS patients. Our laboratory identified Developing Brain Homeobox 1 (Dbx1) as the most upregulated gene in these tumors. Interestingly, DBX1 is also upregulated in ARMS patients, in which PTEN expression is not typically altered. To investigate this, a series of gain-and loss-of-function studies will be performed in human ARMS cell lines, patient-derived xenografts, and

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genetically engineered mouse models. Taken together, our preliminary data suggest a role for DBX1 in both ERMS and ARMS tumorigenesis.

#2 *Visual outcomes after radiation therapy for optic pathway gliomas* ◙
Sophia Quesada; Kenneth Coca, Mary Hoehn, MD, Ibrahim Qaddoumi, MD, Thomas Merchant, DO/PhD, Sahaja Acharya, MD, St. Jude Children's Research Hospital
Faculty Sponsor: David Kabelik, Department of Biology
Optic pathway glioma (OPG) often results in visual acuity (VA) decline. Radiation therapy (RT) is used to treat OPG and the effect of RT on VA is not well understood. The purpose of this study is to estimate the cumulative incidence of VA decline or improvement after RT and to identify risk factors associated with VA decline. From 1997 to 2017, 40 patients were treated with RT for OPG at a single institution and had baseline VA testing. All patients underwent serial VA testing following completion of RT. Extent of surgery was biopsy in 53% of patients and subtotal resection in 40% of patients. Approximately half the of the patients (48%) were previously treated with chemotherapy. The 3-year cumulative incidence of VA decline was 17.9% (95% Confidence Interval [CI]: 7% – 32.8%) and VA improvement was 16.3% (95% CI: 5.6% - 31.9%) for the eye with worse baseline vision. The 3-year cumulative incidence of VA decline was 13.6% (95% CI:4.8% – 26.9%) and VA improvement was 10.6% (95% CI: 2.6% – 25.2%) for the eye with better baseline vision. On univariate analysis, prechiasmatic compared to postchiasmatic tumor location increased the risk of VA decline (Hazard Ratio: 6.23, 95% Cl: 1.17 – 33.1, p=0.031). Less than 20% of patients with OPG treated with RT will experience VA decline or improvement in either eye within three years of treatment. Prechiasmatic tumors are associated with an increased risk of VA decline. Given that these patients survive well beyond their diagnosis, long-term VA surveillance is of paramount importance.

#3 *ALLSUP - Use of transcranial direct current stimulation of the lateral temporal cortex to improve measures of cognitive function in long-term childhood cancer survivors* ◙
Molly Litten, Kevin Krull, Nicholas Phillips, Pia Banerjee, Cynthia Jones, Jeremy Lawson, Adrienne Studaway, Amira Wassef, Sedigheh Mirzaei, Leslie Robison, Melissa Hudson
Faculty Sponsor: David Kabelik, Department of Biology
Individuals who have undergone childhood Acute Lymphoblastic Leukemia (ALL) cancer treatment see cognitive deficits that persist throughout lifetime. Studies have shown that transcranial direct current stimulation (tDCS) can aid in some of these deficits by using a very low level of constant electrical current to stimulate specific parts of the brain. A previous study showed that anodal tDCS stimulation to the frontal lobe of ALL survivors yielded improvement in these cognitive issues. In ALLSUP, cathodal tDCS suppression to the temporal lobe will be tested by targeting a different pathway that is also affected by the chemotherapy agents used in treating ALL: the hyperconnected Default Mode Network (DMN) pathway. The DMN is specifically associated with attention and working memory, so we predict that cathodal

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suppression to this hyperconnected pathway will reduce the activity, improving cognitive function. Subjects will be assessed by an NIH Toolbox Cognitive Battery. Our objectives are to estimate the potential efficacy for powering a larger study and to compare the effect of anodal stimulation of the frontal lobe to cathodal suppression of the superior temporal lobe on cognitive performance. We hypothesize that cathodal suppression to the left superior temporal gyrus will be associated with greater improvement in attention and working memory than anodal stimulation to the left frontal cortex in childhood ALL survivors. The results of this study will guide the further steps of appropriate interventions for these children and larger studies to determine long term effects.

#4 *Hope in the Face of Unlikely Cure: From Parent's and Physician's Perspective* ◙

Sri Velrajan; Kendra Hotz, Department of Religious Studies; Erica C. Kaye M.D. MPH
Faculty Sponsor: Kendra Hotz, Department of Religious Studies

Historically, prognostic communication research has been cross-sectional, retrospective, and reliant on survey methodology, which results in data confounded by selection, information, and recall biases. No studies have utilized recording technology to describe the evolution of prognostic communication across the illness trajectory for children with high-risk cancer. In this paper, we aim to investigate the relationship between high quality prognostic communication and agreement between oncologist (PO) and parents of children with cancer (POCC) perceptions of curability and prognostic understanding. We hypothesize that provision of high-quality prognostic communication will be associated with increased agreement. Mixed methods were used to compare prognostic communication codes applied within initial recorded disease reevaluation conversations with matched validated oncologist/parent surveys, as well as qualitative data from matched semi-structured interviews completed by oncologists, patients, and parents. After triangulating the data, several themes that emerged from the survey responses, interview responses, and the audio recording of the conversation were: 1) POCCs generally had a higher response for likelihood of cure than POs, 2) during surveys, usually POCCs had a difference sense of curability than during the interview, 3) during surveys, POs had a higher response for likelihood of cure than during the interviews, and 4)in general, POCCs had hope despite prognostic uncertainty. This study is the first prospective longitudinal investigation of prognostic communication in pediatric oncology, using audio recording technology to capture medical dialogue. From this, we can develop clinical interventions geared towards improving prognostic understanding, promoting therapeutic alliance, and enhancing overall communication experiences for these patients and families.

#5 *NSD1 is essential for the death of malignant rhabdoid tumors under EZH2 inhibition and could provide insight into better treatment methods* ◙

Margaret Larsen; Yiannis Drosos, Department of Molecular Oncology, St. Jude Children's Research Hospital; Charles Roberts, Department of Molecular Oncology, St. Jude Children's Research Hospital
Faculty Sponsor: Elaine Frawley, Department of Biology

Malignant rhabdoid tumor (MRT) is an aggressive form of cancer that occurs in the kidneys, brain, or soft tissues of pediatric patients. Cell fate and lineage specification are controlled by the chromatin remodeling complex SWI/SNF which mobilizes nucleosomes. Its activity is antagonized by the polycomb repressive complexes (PRC1/2) that silence transcription through the methylation of H3K27. MRT have a mutation in SMARCB1 encoding a core component of SWI/SNF chromatin remodeling complex which thus inactivates complex function. To see whether SWI/SNF mutations affected the interactions of the complexes with other subunits, rhabdoid and control cell lines were tested through immunoprecipitation, glycerol sedimentation analysis, and western immunoblots. The histone methyltransferase NSD1 showed the most promise as it has interactions with SWI/SNF and PRC1/2 components only in the control versus the rhabdoid cell lines. Also, a genome-wide screen showed that loss of NSD1 resulted in resistance of the MRT to EZH2 inhibition. Inhibitors of EZH2, a key component of PRC2, have progressed to phase II clinical trials for SMARCB1-mutant cancers. Although the results are promising, some resistance has emerged resulting in the study of NSD1 to help in predicting resistance mechanisms. Quantitative PCR experiments were performed to determine expression levels of PRC2 gene targets, some of which are typically tumor suppressors, in relation to presence of NSD1. So far, the data collected have shown NSD1 as essential for the death of tumor cells under EZH2 inhibition. Therefore, further understanding the mechanism behind resistance will help us better understand malignant rhabdoid tumors.

#6 *Reducing Risk of Necrosis in Children with Recurrent Ependymoma Treated with a Second Course of Irradiation* ◙

Walker Laird; Chia-ho Hua, Jinsoo Uh, Melissa Gargone, and Thomas E. Merchant, Department of Radiation Oncology, St. Jude Children's Research Hospital
Faculty Sponsor: Jonathan FitzGerald, Department of Biology

Radiation necrosis is a potentially devastating complication associated with radiation therapy (RT). Early prediction and prevention would be highly beneficial. This study examined the radiation dose-volume parameters in children who developed brain necrosis after re-irradiation (reRT) for recurrent ependymoma. We analyzed composite RT plans for 31 patients with recurrent ependymoma who received reRT on a prospective trial between 2014 and 2017. The median age of the study group was 9.0 years (range 3.5-20.4 years). Longitudinal MR images were registered to RT dose distributions to determine dose to necrotic regions. Eleven patients developed necrosis involving the brainstem (4 with grade 1 per CTCAE, 3 with grade 3) or brain (1 with grade 1, 3 with grade 3) during or after reRT. The median onset time was 4 months (range, 1.25-12 months) after the start of reRT. Necrosis appeared in medulla, pons, middle

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cerebellar peduncles, thalamus and frontal, parietal, or occipital lobes. Necrosis occurred only in patients receiving cumulative doses >105 Gy (brainstem, 7/17) or >108 Gy (other brain regions, 4/14). Doses to brainstem necrotic areas were >100 Gy. The time interval between previous courses and re-irradiation did not separate patients with and without brainstem necrosis treated to cumulative doses >105 Gy. Data suggested the risk of necrosis increased significantly when the cumulative dose exceeded 105 Gy to brainstem or 108 Gy to brain. Before other predictive factors are identified, radiation therapy plans should be designed to respect these constraints taking into account the competing risks associated with reduced target volume coverage.

#7 *FSTL1 Expression in the Hematopoietic Hierarchy* ◙

Pramika Sriram, Trent Hall, Department of Experimental Hematology, St. Jude Children's Research Hospital; Shannon McKinney-Freeman, Department of Experimental Hematology, St. Jude Children's Research Hospital

Faculty Sponsor: William Eckenhoff, Department of Chemistry

Bone marrow transplants are actually the transplantation of hematopoietic stem cells (HSCs), which are able to self-renew and differentiate into all blood lineages. The ability of hematopoietic stem cells to effectively engraft and reconstitute ablated bone marrow is partially dependent on genetic factors. FSTL1 is a gene that is expressed in a variety of stem cell populations, including HSCs. In previous experiments, FSTL1 has been shown to be a negative genetic regulator of HSC engraftment and reconstitution. When FSTL1 is knocked down with shRNA, the ability of HSCs to engraft and reconstitute bone marrow in murine systems decreases. There was previously little data about FSTL1 expression levels in HSCs and downstream blood lineages. Through flow cytometry and RT-qPCR techniques, data has been collected to show that FSTL1 is most highly expressed in HSCs and other multipotent progenitor populations. FSTL1 is expressed at lower levels in downstream blood populations, such as the myeloid and lymphoid lineages. Additionally, it is critical to note that FSTL1 is a secreted glycoprotein; as such, there is potential to exogenously treat HSCs with FSTL1 prior to transplantation to increase engraftment and repopulating potential.

#8 *Characterizing the Phase Separation Potential of NUP98 Interactors for Co-localization within NUP98 Fusion Oncoprotein Cellular Puncta* ◙

Ramiz Somjee, Diana Mitrea, Richard Kriwacki

Faculty Sponsor: Terry Hill, Department of Biology

The NUP98 protein is mostly localized to the nuclear pore complex (NPC) where it helps form a permeability barrier to regulate nuclear transport. The formation of this barrier is driven by self-interactions between phenylalanine-glycine (FG) repeats within NUP98's N-terminal intrinsically disordered region. Through a mechanism termed phase separation, these self-interactions allow NUP98 to demix from the nucleoplasm and form the permeability barrier in the NPC. However, in many cases of pediatric acute myeloid leukemia (AML), the FG repeat

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domain of NUP98 is fused with the homeobox domain (responsible for binding to promoters of specific genes) of the HOXA9 protein. The resulting fusion protein, NUP98-HOXA9 (NHA9), forms nuclear puncta and re-programs gene expression. However, how these puncta alter gene expression is poorly understood. We hypothesize that, like NUP98 in the NPC, these puncta form through self-interactions of the FG repeats. A potential mechanism for gene-regulation is that transcriptional regulators are selectively incorporated into these puncta based on their ability to interact and phase separate with NHA9. To test this hypothesis, we searched the NUP98 interactome using sequence analysis algorithms to identify transcriptional regulators with the potential to undergo phase separation. From a list of about 35 phase separation-prone NUP98 interactors, we selected 7 for experimental testing. We used turbidity assays to evaluate whether selected interactors phase separated in vitro. Finally, we probed if mechanisms of self-association were electrostatically or hydrophobically driven by assaying proteins in buffers of varying ionic strengths. Our results suggest that several transcriptional regulators known to interact with NUP98 can phase separate in vitro and potentially mis-regulate genes through co-localization within NHA9 puncta.

#9 *Innate immune stimulation may serve as a second hit in an osteochondroma mouse model* ◙
Emmaline Wittwer, Marie Wehenkel, Spencer Richardson, Maureen McGargill
Sponsor: Marie Wehenkel, St. Jude Children's Research Hospital
Hereditary multiple exostoses (HME) is a disease that presents multiple osteochondromas, which are benign cartilage-capped outgrowths of bone. The complete mechanism of tumor formation is unknown, although many, but not all, patients have mutations in either EXT1 or EXT2. Interestingly, Ext1+/- and Ext2+/- mutant mice are not a good model of HME, although double heterozygous Ext1+/-.Ext2+/- mice demonstrate higher tumor incidence. These findings suggest that Ext mutation alone is insufficient to drive the formation of multiple osteochondromas, so the field is now looking for a second hit model. Knowing that the immune system interacts with the skeletal system, we stimulated the innate immune system in Ext mice with the hypothesis that treated mice would present with enhanced osteochondroma incidence and/or severity. Using an asthma model, we found that treated Ext1+/- mice formed more, but smaller, tumors than control mice. Treating Ext1+/-.Ext2+/- mice with sequential adjuvant therapy significantly increased tumor incidence compared to untreated mice. These findings suggest that an immune response may be a sufficient second hit. Future studies will examine Ext mutant mesenchymal stem cells (MSC) compared to WT MSCs to test if mutation alone leads to altered differentiation or morphology and if inflammatory factors alter these indicators.

Sciences

#10 *Design and Synthesis of Potential Aryl-Substituted LpxC Enzyme Inhibitors*

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Jacob Greenberg, Andrea O. Pajarillo, Rebecca J. Roldan, Carter P. Embry; Mauricio Cafieroand Larryn W. Peterson, Department of Chemistry
Faculty Sponsor: Larryn Peterson, Department of Chemistry

LpxC, an enzyme that is involved in the first step of the biosynthesis of Lipid A, has become a vital target in the development of antibacterial treatments for Gram-negative bacteria. By inhibiting LpxC, the production of Lipid A would be halted and the outer membrane of the Gram-negative bacteria would be altered to the point in which it could not function. The synthesis of inhibitors of LpxC is critical due to the growing threat of antibiotic resistant bacteria and the limited set of pathways in which the enzyme can be blocked. A zinc ion region, a polar region, and a hydrophobic passage have been identified in the LpxC active site. In order to optimize binding at the active site, multiple potential inhibitors were designed and synthesized with an assortment of hydrophobic tails to mimic the hydrophobic passage and increase the viability of binding to the active site. Recent bacterial assays have shown that some of the proposed analogues have activity against bacteria. The synthesis of these compounds with will be discussed.

#11 *Local network synchronization in the rat dorsal and ventral hippocampus throughout development*

Steven Mysiewicz; Kelly Ann Dougherty, Department of Biology
Faculty Sponsor: Kelly Dougherty, Department of Biology

Medial temporal lobe epilepsy (mTLE) is a prevalent form of focal epilepsy defined by spontaneous recurrent seizures generated within the medial temporal lobe - seizure foci that originate within the hippocampus are especially common. Interestingly, the probability that the local hippocampal network will synchronize and precipitate a seizures varies with location along the longitudinal hippocampal axis, such that the anterior hippocampus (rather than the posterior hippocampus) is most often associated with seizure generation and hippocampal sclerosis. Moreover, the seizures associated with mTLE tend to begin during adolescence, and continue into adulthood. Given the age, and location dependence of seizure generation in the hippocampus, we sought to explore the mechanisms of local network synchronization across the longitudinal hippocampal axis throughout development using Sprague-Dawley rats ranging from two weeks to six months old. Here, network synchronization was accompanied by applying 0 mM Mg^{2+} artificial cerebrospinal fluid to acute hippocampal slices at near physiological temperature (31-33 degrees C), while network activity was monitored using an extracellular electrode placed in the CA1 cell body layer. Interestingly, the dorsal hippocampus (DHC; the rodent homolog of the human posterior hippocampus) transitioned from hyperexcitable to hypoexcitable (determined by steady-state event frequency) throughout development, whereas the activity within the ventral hippocampus (VHC) remained stable throughout the developmental timeframe. This result suggests significant remodeling of the local circuits within the DHC throughout development, which presumable protect this region from inappropriate

network synchronization, and, by extension, could shed light onto the mechanisms of the seizure generation in adolescents with mTLE.

#12 *Comparative Analysis of Tools for Predicting the Functional Impact of mtDNA Variants* ◙
Madeline P. Griffin
Faculty Sponsor: Catherine Welsh, Department of Mathematics and Computer Science
Recent advances in DNA sequencing technologies has transformed the study of DNA sequence variation. Over the last decade, the development of functional impact predictors and annotation tools have been implemented to aid in DNA variant analysis. While many annotation tools and pipelines have been built to annotate nuclear genome variants, only a few software predictors address the thousands of variants found in mtDNA. Many prediction tools built for nuclear DNA have been retrofitted to annotate mitochondrial DNA, but because of the vast differences between the two, nuclear annotators fail to produce accurate predictions for mitochondrial mutations. We constructed a comparative analysis of both standard and non-standard annotation tools and their ability to accurately predict the pathogenicity of mitochondrial mutations. We curated a complete list of all potential non-synonymous exonic, tRNA and rRNA mitochondrial mutations and ran selected tools for each dataset. We then analyzed the accuracy and precision of each tool compared to the consensus among the tools combined with pathogenicity predictions from MITOMAP disease associations. We confirmed that many prediction tools typically used for nuclear DNA were subpar when tested on mitochondrial DNA. Newer annotation tools built specifically for mtDNA, such as APOGEE, had higher overall assessment scores.

#13 *Synthesis of Dopamine and L-DOPA Analogues*
Erykah Starr, Rishabh Mazumder , Skylar Cochrane; Mauricio Cafiero and Larryn Peterson, Department of Chemistry
Faculty Sponsor: Larryn Peterson, Department of Chemistry
L-DOPA, a dopamine precursor, is widely used in the treatment of dopamine deficiency, as it can cross the blood-brain barrier and upon entering the brain, be converted into dopamine. Enzymes in the biosynthetic pathways can interrupt this process by converting the L-DOPA into undesired metabolites. Dopamine analogues with substituents at the 6-position on the catechol ring are being synthesized to test their interactions with those different enzymes. This work will discuss the synthesis of dopamine and L-DOPA analogues.

#14 *Localization of mutant forms of the PaxB and Hof1 proteins in Aspergillus nidulans*
Kudzai Nyamkondiwa, Trang Ho, Loretta Jackson-Hayes
Faculty Sponsor: Terry Hill and Loretta Jackson-Hayes, Department of Biology
Previous work in our lab and work by other researchers (Zhou 2018; Kaufmann and Philippsen, 2009) has shown that the PaxB and Hof1 proteins are essential for actin ring formation and cytokinesis in filamentous fungi. PaxB localizes to septation sites and growing hyphal tips. Hof1

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in Ashbya gossypii and A. nidulans has been shown to localize to septa. Previously in the lab, the chemical mutagen NQO was used to generate random mutations in the paxB and hof1 genes. The mutant form of the PaxB protein is temperature sensitive in that the strain cannot form septa at 42°C due to a point substitution. The mutant hof1 gene has a premature stop codon which causes a truncation in the encoded protein. Both mutations result in the formation of aseptate hyphae. We manipulated the mutant versions of the paxB and hof1 genes so that the encoded proteins contain GFP tags at their C-terminals. Using fluorescence microscopy, we observed that the mutant PaxB and Hof1 proteins localize to septation sites in a normal manner. This supports the conclusion that the loss of function of mutant PaxB and Hof1 proteins are not due to incorrect localization.

#15 *Determination of Catechol Analogues' pKa Values Using UV-Vis Spectrophotometry*
Alexa Alana, Keri Colabroy; Mauricio Cafiero and Larryn Peterson, Department of Chemistry
Faculty Sponsor: Larryn Peterson, Department of Chemistry
The ionization constant (pKa) of a substrate is a physiochemical parameter that significantly affects its affinity and behavior in its corresponding enzyme's active site. In previous studies, a library of catecholic compounds was designed, synthesized, and analyzed in the active site of a variety of enzymes, such as L-DOPA dioxygenase and SULT1A3, in order to obtain a deeper understanding of the substrate space and mechanics underlying enzymatic functions. Because the abstraction of the proton is an essential step in the various enzymes' mechanisms, this study aims to utilize the pre-made catechols and characterize their pKa values with Ultraviolet-Visible Spectrophotometer, which will be discussed.

#16 *The Effects of Herd Members and Spatial Location on the Stereotypic Behaviors of a Captive Elephant* ◙
Julianna Szuwalski, Sofia Karabell, Claire McGuire, Guilia Ferrari
Faculty Sponsor: Sarah Boyle, Department of Biology
The African elephant (Loxodonta africana) is the largest land mammal on earth, and is found in zoos across the world. Stereotypic behaviors, behaviors defined as invariant, regularly repeated, and having no apparent goal or function, are sometimes displayed by animals in captivity. In August 2018 two new elephants (Bambi and Daisy) were introduced to the existing three elephants (Tyranza, Gina, and Asali) at the Memphis Zoo. Since her arrival, Bambi has displayed a stereotypic behavior involving swaying and rocking. We seek to determine if certain factors, such as the presence of the original three elephants or spatial location of Bambi, influence the frequency of this behavior in Bambi. We predict that the swaying behavior will be more frequent in Bambi when the original three elephants are present and when Bambi is on the right side of the exhibit because the left side has fewer objects in it. Results from this observational study will

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help to potentially minimize stereotypic swaying of the elephants at the Memphis Zoo and can be used by other zoos to resolve other stereotypic behaviors as well.

#17 *Understanding the Molecular Basis of the Interaction between NPM1 and ALS-associated R-rich Dipeptide Repeat Polypeptides* ◙

Patrick Wilkerson; Michael White PhD, Richard Kriwacki PhD, St. Jude Children's Research Hospital

Faculty Sponsor: Dhammika Muesse, Department of Chemistry

The expansion of the GGGGCC hexanucleotide repeat in the C9ORF72 leads to the creation of toxic dipeptide repeats from both the sense and antisense reading frames. This expansion is the leading cause of amyotrophic lateral sclerosis (ALS) and frontotemporal dementia (FTD). Normally, these dipeptide repeats are repeated 23 times or less but patients with ALS/FTD have more than thirty repeats with repeats of over 1000 observed. Five polypeptides, glycine-alanine (GA), glycine-arginine (GR), proline-arginine (PR), proline-alanine (PA) and glycine-proline (GP) are produced with arginine containing DPRs (GR and PR) being toxic to the cell. These peptides appear to disrupt the function of RNA-binding proteins with low complexity sequence domains. One protein these peptides interact with is the nucleolar protein NPM1. NPM1 is responsible for the liquid-liquid phase separation of RNA and proteins within the nucleolus. Toxic DPRs have been shown to disrupt this function in vitro. In this study, we aim to understand the molecular basis of the interaction of R-rich toxic DPRs and NPM1 by studying the Liquid-Liquid phase separation propensity of DPRs with varied repeat sequences with NPM1.

#18 *Synthesis of Dopamine and DHHCA Analogues*

Kishan Sinojia, Mark Betonio, Alexa Alana, Hamid Shirwany, Keri Colabroy; Mauricio Cafiero and Larryn Peterson, Department of Chemistry

Faculty Sponsor: Larryn Peterson, Department of Chemistry

Catechols, specifically dopamine and related analogues, have numerous important biological functions. They are modified by various enzymes, such as L-DOPA dioxygenase and sulfotransferases. L-DOPA dioxygenase has a unique mechanistic trait, coordinating the extradiol cleavage and degradation of an aromatic ring by vicinal oxygen chelation. Sulfotransferases, known as SULTs, are vital for the biotransformation and subsequent transportation of xenobiotics, neurotransmitters, and other compounds. With successful synthesis of these compounds and deeper understanding of substrate space, structure and function, there is an opportunity for expanding substrate tolerance and utility of these classes of enzymes. A library of catecholic substrates, including those of dopamine, L-DOPA, and 3,4-dihydroxyhydrocinnamic acid (DHHCA), are in the works of being designed, synthesized, and analyzed in the biological assays. The synthesis of these compounds will be discussed.

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#19 *Network Analysis: Spectral and Centrality Measures*

Alfred Rohde

Faculty Sponsor: Eric Gottlieb, Department of Mathematics and Computer Science

Graph Theory provides a computational framework for modeling a variety of data sets. This branch of mathematics also allows analytical computations to be done on a set of connected data. Networks representing social groups, internet connections, and transportation grids can all be modeled as a graph and analyzed for its centrality and spectrum. Centrality is a method of computing the "centrality" or approximate importance of each node in a graph. There are multiple types of centrality calculations that can highlight the value of a vertex. Graphs can also be analyzed spectrally, by solving for the eigenvalues of a graph's adjacency matrix. These values describe a graph's connectivity and can be applied to complex systems such as the Internet, and social networks. This project applies these techniques to a familiar graph, the network of Rhodes College's sidewalks. This will supply information about the relationship between the connection points of the sidewalks on campus. Centrality shows the center of campus that receives the most traffic and also displays the regions of campus that lacks good connections to the more important locations of campus.

#20 *Upregulated DBX1 in a murine model of ERMS and human ARMS patients suggests a common link in RMS tumorigenesis* ◙

Kristin Reed; Casey G. Langdon, Department of Oncology, St. Jude Children's Research Hospital; Johnathan Dallman, Kansas State University; Mark E. Hatley, Department of Oncology, St. Jude Children's Research Hospital

Faculty Sponsor: Michael Collins, Department of Biology

Rhabdomyosarcoma (RMS) is the most prevalent childhood soft tissue sarcoma, making up 50% of these tumors. RMS is divided into four categories: embryonal RMS (ERMS), pleomorphic RMS, spindle cell RMS, and alveolar RMS (ARMS). Patients with ARMS are most likely to present with metastasis and have the worst prognoses, especially compared to patients with ERMS, the most common subtype. Patient survival has not improved over the past 30 years, with requisite aggressive treatment often increasing the risk that children will develop additional malignancies later in life and/or experience significant co-morbidities, including disfiguring surgery. Future research into the molecular mechanisms responsible for RMS tumorigenesis aims to improve treatments and clinical outcomes. To better understand the origins of RMS, our laboratory developed a highly penetrant, early onset, Hedgehog-driven ERMS model. Loss of PTEN expression is seen in 90% of ERMS patients, suggesting an important role for the gene in RMS tumorigenesis. Our mouse model has been further augmented by the genetic deletion of the Pten tumor suppressor, resulting in tumors more closely resembling those seen in ERMS patients. Our laboratory identified Developing Brain Homeobox 1 (Dbx1) as the most upregulated gene in these tumors. Interestingly, DBX1 is also upregulated in ARMS patients, in which PTEN expression is not typically altered. To investigate this, a series of gain-and loss-of-

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function studies will be performed in human ARMS cell lines, patient-derived xenografts, and genetically engineered mouse models. Taken together, our preliminary data suggest a role for DBX1 in both ERMS and ARMS tumorigenesis.

#21 *Design and Synthesis of Novel Unnatural Amino Acids and their Application in Creating Antibiotic Polypeptides*

Morgan McDonald, Gianna DeLuco; Kimberly A Brien and Roberto de la Salud Bea, Department of Chemistry

Faculty Sponsor: Kimberly Brien, Department of Chemistry

Synthesis of amino acids with antimicrobial properties aims to mediate the toxicity of natural venoms arising in scorpion stings. Some chemical changes in amino acids increase their antibiotic activity, allowing them to counteract toxicity. There are several naturally occurring unusual types of amino acids such as D-amino acids, beta-amino acids, and N-methylated amino acids. The Bea lab is synthesizing unnatural amino acids containing side chains with a series of uncommon functional groups may have the potential to increase antibiotic activity. These novel compounds have a wide spectrum of hydrophobic, polar, and basic properties that introduce selective modifications in sequencing antimicrobial peptides from natural venoms. Synthesis of unnatural amino acids is a promising avenue for mediating the effects of toxic compounds.

#22 *Generation of Aza-Crown Ethers Using 2,6-bis-hydrazinopyridine*

Dillon Mosman, Amanda Salazar; Kimberly A Brien, Department of Chemistry

Faculty Sponsor: Kimberly Brien, Department of Chemistry

2,6-bis-hydrazinopyridine (BHP) has been prepared and is used in the preparation of chelating ligands that are otherwise more difficult to generate. The generation and isolation of 2,6-bis-hydrazinopyridine occurs through the reaction of 2,6-difluoropyridine with anhydrous hydrazine to generate the crude product followed by treatment with NaOH to isolate the BHP. BHP has been as a useful reactant in the preparation of 2,6-bispyrazoylpyridines, but further research has indicated that it may also provide a useful way to generate nitrogen-based aza-crown macrocycles through a reaction with 1,2-dibromoethane.

#23 *Qualitative and Quantitative Analysis of Purity and Composition in Lavender Essential Oil*

Leda St. Cyr, Hannah Cantwell; Kimberly A Brien, Department of Chemistry

Faculty Sponsor: Kimberly Brien, Department of Chemistry

Essential oils are intended for topical and diffusion uses only, but are often misused as flavor additives. As these oils are not designed for consumption or medicinal purposes, the FDA does not monitor their production. As such, they might contain harmful volatile organic compounds (VOC) that are not suitable for human ingestion. This experiment was conducted to evaluate the purity and composition of essential oils. The purity of a sample from one lavender essential oil brand was analyzed before and after distillation with HNMR. Peaks not present in the distilled

lavender essential oil spectra will undergo comparative analysis with pure samples of suspected compounds, which may allow us to detect the presence of VOCs in lavender essential oil. Future analyses will be done via GC, CNMR, and IR.

#24 *Design of Novel Inhibitors for the Catechol-O-Methyltransferase Enyzme*
Emma Cook, Katherine Hatstat; Larryn W. Peterson and Mauricio Cafiero, Department of Chemistry
Faculty Sponsor: Mauricio Cafiero, Department of Chemistry
Parkinson's disease is characterized by a decrease of dopamine levels within the brain. L-Dopa is commonly used in the clinical treatment of Parkinson's disease, as it is able to cross the blood brain barrier when dopamine cannot. DOPA-decraboxylase transforms L-DOPA into dopamine. Dopamine derived from L-DOPA is deactivated via metabolism by the COMT enzyme. Catechol-O-methyltransferase is an enzyme that degrades catecholamines such as dopamine, epinephrine, and norepinephrine. L-DOPA is a precursor of catecholamines and is therefore an important substrate of COMT. This targeted inhibition of the COMT enzyme prolongs the effectiveness of L-DOPA, resulting in a net increase in pharmacological efficiency. By selectively designing an inhibitor for the COMT enzyme, the effectiveness of L-DOPA can be extended through regulating the metabolism of dopamine derived from L-DOPA. The effectiveness of these dopaminergic derivatives has been measured via in silico models in which the strength of interaction between each substrate and the enzymatic active site was analyzed. A crystal-structure of the COMT enzyme active site, docked with a known COMT inhibitor, BIA 8-176, was isolated from the Protein Data Bank (PDB ID:2CL5). Novel dopaminergic derivatives were optimized using M062X/6-31G in vaccum and in implicit solvation with rigid amino acid side-chains. Interaction energies between ligands and the protein were then calculated using MO6L and the 6-311+G* basis set. A recently developed set of molecules that are more selective for increasing dopamine has been tested.

#25 *Brain-Derived Neurotrophic Factor Concentrations in Peripheral Organs of Wild-Type and Promoter IV Defective Mice Across Standard Caged and Enriched Environment Treatments* ◙
Will Schupp; Dr. Kazuko Sakata UTHSC Department of Pharmacology, Shannon O'Brien UTHSC Department of Pharmacology
Faculty Sponsor: David Kabelik, Department of Biology
Recent literature has suggested that Promoter IV of the brain-derived neurotrophic factor (BDNF) gene locus is critical to neuromodulatory prevention against depression and that, when Promoter IV is defective, low BDNF concentrations in the brain and depressive behaviors in mice are resultant, both of which can be reversed through enriched environment treatment (EET), an experimental proxy for antidepressants and their efficacy. These BDNF levels have been well investigated in the brain, but BDNF protein's presence remains to be investigated in the majority of peripheral tissues in these conditions. This study sought to establish BDNF levels

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in peripheral tissues of normal wild-type (WT) and deficient BDNF through defective Promoter IV (KIV) mice that were categorized into either a standard cage treatment (SCT) or enriched environment treatment (EET). Through multiple BDNF-enzyme linked immunosorbent assays (ELISAs) coupled with DC Total Protein Assays, it was found that, often independent of treatment type, BDNF concentrations in peripheral organs of KIV animals were higher than WT animals, while these levels remained higher in WT animals in brain tissue. Our findings pointed towards a mechanism that results in enhanced presence of BDNF protein in peripheral organs when Promoter IV is defective in comparison with the normal wild-type genotype either through transport via platelets in the bloodstream, peripheral nerve innervation, or higher levels of compensatory expression through other BDNF gene promoters, signifying the potential pervasiveness of BDNF protein in peripheral organs of depressed subjects. With BDNF's presence in peripheral systems documented, future directions could elucidate specific roles that this protein has in these organs.

#26 *Movement patterns and survival of headstarted dusky gopher frogs* ◙
Bill Hague, David A. Pike, Elizabeth A. Roznik
Faculty Sponsor: David Pike, Department of Biology
The success of captive-breeding and reintroduction programs depends on the survival of the animals released. Detailed studies on the movement patterns and survival of released individuals can be used to guide reintroduction and habitat management efforts. The endangered dusky gopher frog (Lithobates sevosus) occurs in longleaf pine forests in the southern United States, and has declined due to habitat loss and degradation. Memphis Zoo aims to establish a new population of dusky gopher frogs by breeding them in captivity and releasing their offspring into restored habitat at Ward Bayou Wildlife Management Area, Mississippi. We radiotracked 53 juvenile frogs for 24 days post-release to study their movement patterns and survival. Overall, 76% of released frogs survived until the end of the study. Frogs moved an average of 25 m daily and up to 426 m total during the study, and larger frogs moved farther distances than smaller frogs. Frogs released at the pond moved more often, moved longer distances, and had lower survival rates than frogs that were released into burrows in the uplands. Dusky gopher frogs spend much of their time in underground shelters, and our study suggests that releasing frogs directly into burrows is a useful conservation strategy. Overall, we found that captive-bred frogs successfully transitioned to their natural habitat, providing a positive outlook for the reintroduction program. The findings of this study will be used to guide future plans for releasing dusky gopher frogs and improving their habitat.

#27 *Habitat use and survival of captive-bred dusky gopher frogs released into the wild* ◙
Madeline Estes, Betsy Roznick, Department of Research and Conservation, Memphis Zoo
Faculty Sponsor: David Pike, Department of Biology

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Captive-breeding and reintroduction programs are important ex situ conservation strategies that are being used to conserve endangered species. For these programs to be successful, the released individuals must be able to survive in the wild. Survival is often dependent on habitat quality and the ability of individuals to locate important habitat features. The endangered dusky gopher frog (Lithobates sevosus) occurs in longleaf pine forests in the southern United States, and has declined due to habitat loss and degradation. Memphis Zoo aims to establish a new population of dusky gopher frogs by breeding them in captivity and releasing their offspring into restored habitat at Ward Bayou Wildlife Management Area, Mississippi. We radiotracked 53 juvenile frogs for 24 days post-release to study their habitat use and survival. Frogs selected locations with low canopy cover and abundant groundcover, and they sheltered in stump holes and burrows dug by gopher tortoises and small mammals. Overall, 76% of released frogs survived until the end of the study, and frogs that used at least one underground shelter had higher survival rates than frogs that remained aboveground. Our study shows that captive-bred frogs successfully transitioned to their natural habitat, and it highlights the importance of maintaining open-canopy habitat with a high density of underground shelters. Our findings provide a promising initial outlook for the reintroduction program and will be used to guide future reintroduction and habitat management efforts for this endangered species.

#28 *Elucidating the relationship between MtlA and Pkc in* Aspergillus nidulans

Stewart Nichols, Lydia Slyter

Faculty Sponsor: Darlene Loprete, Department of Chemistry

Fungi have beneficial and deleterious effects on the environment, industry and human economy. Fungi grow as filamentous cells, called hyphae, and contain a cell wall which is essential for the growth and maintenance of the organism. This research involves the gene, MtlA, which affects cell wall integrity in the filamentous fungus Aspergillus nidulans. Plasmid-borne, extra copies of MtlA can suppress the calC2 mutation in the A. nidulans orthologue of protein kinase C (Pkc), which results in hypersensitivity to the chitin-binding agent Calcofluor White (CFW). This correlates with defects in the cell wall. In order to better understand the relationship between Pkc and MtlA, we have developed a strategy to knockout the MtlA gene and replace it with the gene for riboflavin biosynthesis (ribA) from Aspergillus fumigatus. We will transform the newly created strain with Pkc plasmid copies and will demonstrate the ability of Pkc to rescue the altered phenotype. We are currently working on two main projects. For the first project, we have PCR amplified a 1kb upstream piece and ligated it into the plasmid pGem4Z. Our next steps will be to ligate ribA marker and the corresponding downstream piece into the plasmid to create a complete MtlA knockout piece. Secondly, Pyr4 already exists in a strain harboring MtlA under a regulatable promoter, so we are currently attempting to swap out Pyr4 for ribA in plasmids containing Pkc and Pkc-GFP. Eventually, we want to control the epigenetic mechanisms of Pkc to determine if it can complement the phenotype of MtlA.

#29 *Thiosalen Nickel Complexes as Light Driven Proton Reduction Catalysts* ◙
Mary Neil Hodl, Phillips Hutchison, Cameron Tinker, Sri Manohar; William Eckenhoff, Department of Chemistry
Faculty Sponsor: William Eckenhoff, Department of Chemistry
As our global population grows, our need for innovative energy sources also grows. One new energy source can be found through the use of artificial photosynthesis to produce hydrogen gas. We are currently investigating the effectiveness of nickel complexes with thiosalen ligands, specifically [Ni(tsalen), Ni(tsalphen), and Ni(tsaltol)=(tsalen=N,N'-ethylene-bis(thiosalicylideneimine); tsalphen=N,N'-phenylene-bis(thiosalicylideneimine); tsaltol=4-methyl-1,2-phenylene-bis(thiosalicylideneimine))], acting as catalysts for artificial photosynthethesis. Hydrogen production has been measured electro-catalytically and photo-catalytically. Hydrogen production was measured in light driven systems with [Ru(bpy)3]2+ and ascorbic acid to yield turnover numbers as high as 270. In an effort to reduce the overpotential of these complexes, we have explored the effects of adding electron withdrawing substituents to the thiolate rings. Select complexes have also been investigated with computational methods to determine frontier molecular orbitals and reduction potentials.

#30 *Substituent effects on solvatochromism of [Mo(bpy)Cl4]*
Keren Lee; William Eckenhoff, Department of Chemistry
Faculty Sponsor: William Eckenhoff, Department of Chemistry
Solvatochromism is the property of a compound that causes it to change color based upon the polarity of the solvent in which it is dissolved. This phenomenon is most strikingly evinced by a compound's variable appearance in solvents of differing polarities. We recently discovered that [Mo(bpy)Cl4]- (bpy = 2,2'-bipyridine) is highly solvatochromic, shifting over 100 nm in different solvents. We sought to better understand the nature of this solvatochromism by exploring the effect of various electron donating and withdrawing groups, specifically 4,4'-dimethyl-2,2'-bipyridine (dmbpy) and 2,2'-bipyridyl-4,4'-dicarboxylic acid (dcbpy). Electron donating methyl substituents slightly blue-shifted the solvatochromism, while the strongly electron withdrawing carboxylic acid substituents red-shifted it. These observations correlated with electrochemical analysis which showed that the MoIII/MoII couple was very sensitive to the substituents while the MoIV/MoIII couple was not. Interestingly, the [Mo(dcbpy)Cl4]- was very stable in both acidic and basic aqueous environments, the former causing a red-shift resulting from protonation of the carboxylic acid groups. Other pyridine based ligands, such at 2,2′-bipyrimidine (bpm) and 2,2′:6′,2″-terpyridine (tpy) will also be investigated.

#31 *Analyzing Protein Kinase C Interactions With Rho-type GTPases in the Filamentous Fungus Aspergillus nidulans*
Muhammad Hameed, Maleiah Carroll, Alexis Craft, W. Toler Freyaldenhoven, Brianna Betton, Lynsey Campbell, David Vanderwall; Terry Hill, Department of Biology

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Faculty Sponsor: Loretta Jackson-Hayes, Department of Chemistry

Cell division in filamentous fungi involves coalescence and subsequent constriction of a contractile actomyosin ring (CAR), followed by deposition of cell wall material resulting in a septum. The current study focuses on proteins involved in septation in Aspergillus nidulans: protein kinase C (PkcA), formin SepA, and the GTPase Rho4. PkcA contains two putative N-terminal Rho binding domains designated HR1A and HR1B. SepA contains an N-terminal Rho binding domain that upon binding of the appropriate Rho GTPase results in formin activation. Reports from another group suggest that Rho4 is likely the GTPase required for SepA activation. In previous work we showed that in sepA1 temperature sensitive mutant (FH2 domain-L1369S) which is aseptate at elevated temperature, PkcA fails to localize to septation sites at elevated temperature. Here we report via yeast two-hybrid assay that PkcA interacts with SepA via PkcA's HR1A domain and SepA's FH2 domain, and that expressing extra copies of pkcA in a rho4-null mutant increased colony diameter and improved sporulation. PkcA localization to septation sites is reduced in a rhoA mutant while septation is unaffected. The spatiotemporal relationship among the proteins will be further investigated via yeast two-hybrid, bimolecular complementation assays, and localization of fluorescence labeled proteins in mutant strains.

#32 *Determining whether PaxB protein requires actin filaments in order to localize in* Aspergillus nidulans

Catherine Kirkpatrick; Loretta Jackson-Hayes, Department of Chemistry

Faculty Sponsor: Terry Hill, Department of Biology

Based on previous work investigating the paxB gene (AN3659) in Aspergillus nidulans, we hypothesized that the presence of actin filaments is necessary for normal localization of the PaxB protein. To test our hypothesis, we deleted the gene encoding the Profilin protein (AN2484); Profilin is responsible for actin polymerization. In the absence of Profilin we expect there to be no actin filaments present. To delete the profilin gene, a previously generated deletion construct made from Fusion PCR was used to replace the profilin gene encoding region with the Aspergillus fumigatus riboB gene. A fungal strain with GFP (Green Fluorescent Protein) tagged PaxB and RFP (Red Fluorescent Protein) tagged actin was transformed with the deletion construct. As expected, the transformed strain had no visible actin filaments, confirming the deletion of the targeted gene. Additionally, the GFP tagged PaxB did not localize to its normal location, indicating that the presence of actin filaments is necessary for PaxB protein localization.

#33 *Continuation of Trifluoromethyl-bis-acyl-pyridine Ligand and Catalyst Synthesis for Hydrogen Production*

Christopher Turrill, Sam Trenner, Thomas Fowler, Alex Graves; William Eckenhoff, Department of Chemistry

Faculty Sponsor: Dana Horgen, Department of Chemistry

The goal of this research is to synthesize a new ligand trifluoromethyl-bis-acyl-pyridine. Once the ligand has been synthesized, we will collaborate with Dr. Eckenhoff's research group. The Eckenhoff group will work with the ligand as a metal complex to test its suitability as a catalyst for hydrogen production, with practical applications involved with hydrogen fuel cells. A model reaction involving maleic anhydride (ketone) and 2-(2-aminoethyl) pyridine proved unsuccessful(1), however the literature suggests a one pot reaction procedure leading to reaction attempts involving a ketone, metal, and the 2-(2-aminoethyl) pyridine. These reactions between the diketone, ruthenium-metal complex, and substituted pyridine will ideally result in imine formation and ligand-metal in situ(2-3). Previously our group has successfully synthesized the diketone molecule, 1,3-bistrifluroacetyl-4,6,8 trimethyl azulene. The diketone will be mixed with a ruthenium metal complex and 2-(2-aminoethyl) pyridine. The ruthenium metal complexes that will be utilized are ruthenium(III) hydrate and tris(triphenylphosphine)ruthenium(II) dichloride.

#34 *Correlation between bone mineral density measurements performed at different skeletal locations*

Will Newman, Aubrey Gray, Loukas Georgiou, Doni Thomas, Gia Pirro, Evan Main; Brent Hoffmeister, Department of Physics
Faculty Sponsor: Brent Hoffmeister, Department of Physics

Dual-energy X-ray absorptiometry (DXA) is currently the gold standard for diagnosing osteoporosis and predicting fracture risk. DXA is used to measure bone mineral density (BMD) at multiple skeletal locations, typically the hip (proximal femur) and lumbar vertebrae. BMD is known to vary between skeletal locations. The goal of this study was to investigate the correlation between BMD values measured at different skeletal locations. 12 volunteers participated in the study. BMD measurements were performed on four lumbar vertebrae (L1-L4) and on four regions of the proximal femur (trochanter, intertrochanter, Ward's triangle and femoral neck). Linear regression analysis was used to compare BMD values measured at different locations. A total of 56 comparisons were analyzed. The strongest correlation (R = 0.98) was obtained between the right femoral intertrochanter and right femoral Ward's triangle. The weakest correlation (R = 0.00) was obtained between the femoral neck and L4. The results of the study may provide a useful baseline for new techniques that are currently being developed to diagnose osteoporosis.

#35 *A mouse model to study the role of KDM4B in acute myeloid leukemia* ◙

Anoushka Mullasseril; Shivendra Singh, Department of Surgery, St. Jude Children's Research Hospital; Jie Fang, Department of Surgery, St. Jude Children's Research Hospital; Jun Yang, Department of Surgery, St. Jude Children's Research Hospital
Faculty Sponsor: Kimberly Brien, Department of Chemistry

Pediatric acute myeloid leukemia (AML) accounts for 15%–20% of all pediatric acute leukemia cases, with peak incidence in the first 3-4 years of life. Despite advances in therapeutics, 30-40%

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patients will relapse and face poor prognosis. Unfortunately, current therapeutic responses are far from desirable and necessitate formulating strategies to enhance the outcome of anticancer regimens. Chromatin-associated enzymes are required for growth of cancer cells. We have found that the KDM4 gene, which encodes an enzyme for removing histone lysine methylations, is significantly overexpressed in many types of cancer, including AML. This project aims to study the functions of KDM4B in AML using an inducible Cre-Lox system. We generated a KDM4B conditional knockout mouse model by breeding Rosa26-CreERT2 and KDM4B flox/flox mice. KDM4B therefore could be conditionally knocked out by inducing Cre activity either through treating cells with 4-hydroxytamoxifen (4-OHT) in vitro or intraperitoneal injection with tamoxifen in vivo. Cells isolated from fetal liver of Rosa26-CreERT2; KDM4B flox/flox mice with 4-OHT treatment showed KDM4B knockout by genotyping PCR and western blot. These data suggested that this will be a promising mouse model to explore the therapeutic potential of targeting KDM4B for AML.

#36 *Centromeric repeats are differentially silenced*

Meryl Musicante

Faculty Sponsor: Bayly Wheeler, Department of Biology

Heterochromatin, a highly condensed form of DNA and proteins, is required for the accurate partitioning of DNA during cell division. Transcription of the RevCen family of centromeric repeats is required to establish heterochromatin. Establishment is mediated by the RNAi pathway, during which the enzyme Dcr1 degrades RevCen transcripts and recruits heterochromatin, silencing RevCen both transcriptionally and post-transcriptionally. Our lab has shown that RevCen subfamilies—RevCen(dg) and RevCen(dh)—are differentially enriched in heterochromatin, with more heterochromatin present at RevCen(dh). We hypothesized that the increased levels of heterochromatin would enhance silencing of RevCen(dh) elements. To test this, we measured RevCen(dg) and RevCen(dh) transcription in wild-type and dcr1-mutant yeast. We show that in dcr1-mutant yeast, RevCen(dh) and RevCen(dg) transcript levels are similar, arguing that in the absence of heterochromatin both subfamilies of repeats are equally transcribed. In wild-type yeast, however, there are significantly fewer RevCen(dh) transcripts than RevCen(dg) transcripts. These results affirm our hypothesis that RevCen(dh) is more silenced than RevCen(dg). Next, our goal is to determine whether genetic variation within the RevCen promoter affects its silencing. To measure the transcription of a single copy of RevCen in a pool of centromeric transcripts, we engineered RevCen with a novel tag and have validated quantitative PCR primers that specifically recognize it. The tag enables detection of individual copies of RevCen without affecting their function. We will quantify RevCen promoter strengths and assess whether the transcription of RevCen variants is correlated with their ability to establish heterochromatin.

#37 *The ultrasonic backscatter amplitude decay constant (BADCL): relation to bone mineral density*

Aubrey Gray, Evan Main, Will Newman, Loukas Georgiou, Julia Pirro, Doni Thomas; Brent Hoffmeister, Department of Physics

Faculty Sponsor: Brent Hoffmeister, Department of Physics

Osteoporosis is a systemic bone disease characterized by reduced bone strength and increased risk of fracture. Dual energy x-ray absorptiometry (DXA) is used to diagnose osteoporosis by measuring bone mineral density (BMD) at various skeletal locations. Ultrasonic techniques are being developed to perform similar measurements. Ultrasonic systems may offer reduced cost, increased portability and increased safety compared to x-ray systems. The goal of the present study was to compare measured values of an ultrasonic parameter called the backscatter amplitude decay constant (BADCL) to DXA measured values of BMD. 12 volunteers were recruited for the study. BADCL was measured at the left and right heel, left and right hip, and the fourth lumbar vertebral body (L4). BMD was measured at 4 locations on the hip (proximal femur) and 4 lumbar vertebrae (L1, L2, L3 and L4). This presentation focuses on analysis of BADCL and BMD site matched at the left and right hips, specifically the neck of the femur of each hip. Linear regression analysis was used to compare the ultrasonically measured values of BADCL to the x-ray measurements of BMD.

#38 *The Effect of Mutation on the Binding of Ligands in Phenylalanine Hydroxylase* ◙

Rachel Giampapa, Madison Perchik; Mauricio Cafiero and Larryn Peterson, Department of Chemistry

Faculty Sponsor: Mauricio Cafiero, Department of Chemistry

There are many molecules that act on dopamine and dopamine-like binding sites in enzymes and transport proteins. Some effects of these proteins are beneficial while others are detrimental. We are designing inhibitors for this group of proteins. Phenylalanine hydroxylase (PheOH) is a tetradydrobiopterin-dependent monooxygenase that influences the rate determining step of converting phenylalanine into tryrosine by hydroxylating phenylalanine. Both phenylalanine and tyrosine are important components in the anabolism of dopamine. A deficiency of PheOH can cause hyperphenylalaninemia, which gives rise to phenylketonuria (PKU), a severe disease that can cause mental retardation if one's diet is not strictly monitored. A suite of dopaminergic derivatives has been developed as potential inhibitors of the PheOH enzyme. The inhibitory effectiveness of these dopaminergic derivatives has been measured via in silico models in which the strength of interaction between each substrate and the enzymatic active site was analyzed. A crystal-structure of the PheOH active site, with bound thienylalanine, was isolated from the Protein Data Bank (PDB ID: 1KW0). Mutants of the wildtype structure have been created from the crystal structure based on common point mutations. The positions of novel dopaminergic ligands were optimized in the mutant active site using M062X/6-31G with implicit solvation and with flexible amino acid side-chains. Interaction energies between the ligands and the protein

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were calculated using M062X and MP2 with the 6-311+G* basis set. Mutations have shown to have significant effects on ligand binding.

#39 *FSTL1 Expression in the Hematopoietic Hierarchy* ◙

Pramika Sriram; Trent Hall, Department of Experimental Hematology, St. Jude Children's Research Hospital; Shannon McKinney-Freeman, Department of Experimental Hematology, St. Jude Children's Research Hospital
Faculty Sponsor: William Eckenhoff, Department of Chemistry

Bone marrow transplants are actually the transplantation of hematopoietic stem cells (HSCs), which are able to self-renew and differentiate into all blood lineages. The ability of hematopoietic stem cells to effectively engraft and reconstitute ablated bone marrow is partially dependent on genetic factors. FSTL1 is a gene that is expressed in a variety of stem cell populations, including HSCs. In previous experiments, FSTL1 has been shown to be a negative genetic regulator of HSC engraftment and reconstitution. When FSTL1 is knocked down with shRNA, the ability of HSCs to engraft and reconstitute bone marrow in murine systems decreases. There was previously little data about FSTL1 expression levels in HSCs and downstream blood lineages. Through flow cytometry and RT-qPCR techniques, data has been collected to show that FSTL1 is most highly expressed in HSCs and other multipotent progenitor populations. FSTL1 is expressed at lower levels in downstream blood populations, such as the myeloid and lymphoid lineages. Additionally, it is critical to note that FSTL1 is a secreted glycoprotein; as such, there is potential to exogenously treat HSCs with FSTL1 prior to transplantation to increase engraftment and repopulating potential.

#40 *NSD1 is essential for the death of malignant rhabdoid tumors under EZH2 inhibition and could provide insight into better treatment methods* ◙

Margaret Larsen; Yiannis Drosos, Department of Molecular Oncology, St. Jude Children's Research Hospital; Charles Roberts, Department of Molecular Oncology, St. Jude Children's Research Hospital
Faculty Sponsor: Elaine Frawley, Department of Biology

Malignant rhabdoid tumor (MRT) is an aggressive form of cancer that occurs in the kidneys, brain, or soft tissues of pediatric patients. Cell fate and lineage specification are controlled by the chromatin remodeling complex SWI/SNF which mobilizes nucleosomes. Its activity is antagonized by the polycomb repressive complexes (PRC1/2) that silence transcription through the methylation of H3K27. MRT have a mutation in SMARCB1 encoding a core component of SWI/SNF chromatin remodeling complex which thus inactivates complex function. To see whether SWI/SNF mutations affected the interactions of the complexes with other subunits, rhabdoid and control cell lines were tested through immunoprecipitation, glycerol sedimentation analysis, and western immunoblots. The histone methyltransferase NSD1 showed the most promise as it has interactions with SWI/SNF and PRC1/2 components only in the control versus

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the rhabdoid cell lines. Also, a genome-wide screen showed that loss of NSD1 resulted in resistance of the MRT to EZH2 inhibition. Inhibitors of EZH2, a key component of PRC2, have progressed to phase II clinical trials for SMARCB1-mutant cancers. Although the results are promising, some resistance has emerged resulting in the study of NSD1 to help in predicting resistance mechanisms. Quantitative PCR experiments were performed to determine expression levels of PRC2 gene targets, some of which are typically tumor suppressors, in relation to presence of NSD1. So far, the data collected have shown NSD1 as essential for the death of tumor cells under EZH2 inhibition. Therefore, further understanding the mechanism behind resistance will help us better understand malignant rhabdoid tumors.

#41 *Maternal Protectiveness in a Captive Adult Hippopotamus (*Hippopotamus amphibius*)* ◙
Yufei Zhang
Faculty Sponsor: Sarah Boyle, Department of Biology
Native to sub-Saharan Africa, the Nile hippopotamus (Hippopotamus amphibius) is considered one of the most aggressive and dangerous mammals in the world. According to the International Union for Conservation of Nature (IUCN), hippos are currently vulnerable to extinction. Up until March 2017, the Memphis Zoo housed two adult female hippos (Splish and Binti) and one adult male hippo (Uzazi). On March 23, 2017, Binti gave birth to a baby female hippo, Winnie. For more than one year, the Memphis Zoo has been working to reintroduce Binti and Winnie to the other adult hippos. During the process, there has been anecdotal evidence of increased aggressiveness between Binti and other adult hippos. Using scan-sampling data collected since 2016, this project aims to compare and quantify the agonistic behavior occurring between Binti and Splish before and after baby Winnie's birth. Recent findings on hippo maternal relationships and aggression are also reviewed to better elucidate and predict the future agonistic behavioral pattern among the adult hippos and possibly provide suggestions to Memphis Zoo to ensure a less aggressive reintroduction.

#42 *Vasopressin receptor expression in green anole (*Anolis carolinesis*) brains in relation to season (breeding vs. non-breeding) and sex (male vs. female)*
Pooja Dave, Joel Sabio, Gelleana Mendez Morales; David Kabelik, Department of Biology
Faculty Sponsor: David Kabelik, Department of Biology
The social behavior neural network contains a variety of signaling neuropeptides, such as vasopressin (VP), and their receptors. Previous studies in rodents and songbirds have demonstrated that there are differences in neural vasopressin receptor (VPR) expression based on sex (male vs. female) and season (breeding vs. non-breeding). VPRs are G protein-coupled receptors consisting of several subtypes. The V1aR and V1bR subtypes are the most well-known mediators of the effects of VP on social behavior. Understanding differences in receptor expression can help us understand behavioral differences across sexes and seasons. While both males and females show increased amount of reproductive behaviors during the breeding season,

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males also show increased amounts of agonist behaviors during this time period. Using green anoles (Anolis carolinesis), 10 breeding season animals (6 males and 4 females) and 12 non-breeding season animals (6 males and 6 females) were compared for amount of V1aR expression across pertinent brain regions. In order to identify sex-by-season differences, we used autoradiography to measure the expression of V1aR in10 target regions. Expression of V1aR was measured as average pixel brightness for each target region using Photoshop. Based on previous research, we predicted that, in general,breeding males will have higher V1aR expression than females and non-breeding males. We also predicted that there will be no difference in V1aR expression among females between seasons. The technique used in this study can potentially be applied to other investigations such as within-sex differences in behavioral boldness in other species.

#43 *Observing Antibiotic Resistance in Pneumonia through Bacterial Cell Death* ◙
Erin Dindoruk; Dr. Haley Echlin, Dr. Jason Rosch, Dr. Hannah Rowe, Aaron Poole, Enolia Marr, Amy Iverson, Tina Dao
Faculty Sponsor: Dhammika Muesse, Department of Chemistry
Streptococcus pneumoniae is one of the most common strains of bacteria in the world. A problem for todays physicians is that the bacterium has become resistant to many different commonly prescribed antibiotics. Because of this resistance, it's important for scientists to determine which antibiotics are most effective in eliminating the bacterium.
In order to determine the most effective antibiotic, we set up a "kill curve", where we counted the number of incubated bacterial colonies every hour for four hours. For the experiment, 3 different strains of pneumonia were used: A wild type strain (T4), two mutant strains (Δ1739 and Δ1790), and a double mutant which was a hybrid of both the Δ1739 and Δ1790 strains. The 3 different antibiotics used were Ciprofloxacin, Cefepime, and Linezolid. After growing the strains and plating them on blood-agar plates, we counted the number of colony forming units (CFUs) on each plate for each strain. The more CFU's, the greater resistance the strain had to a particular antibiotic.

It was predicted that the T4 strain and Δ1790 strains would have the least resistance to all three antibiotics, followed by the Δ1739 strain and the Double Mutant. However, for Cefepime, ,Δ1739, T4, Δ1790 were all equally susceptible to the antibiotic and each had very little resistance when compared to the Double Mutant. For Linezolid, all 4 strains showed considerable resistance, yet had suppressed growth.

#44 *Cobalt complex with dithiothiophene ligand for the Light Driven Production of H2* ◙
Liam Rhodes, Mary Neil Hodl
Faculty Sponsor: William Eckenhoff, Department of Chemistry
Over the next century, the world's population is expected to increase at a drastic rate; therefore, it is essential to consider new and more efficient sources of energy such as the use of artificial

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photosynthesis to generate hydrogen gas. Hence, the development of more active and robust catalysts is necessary in order to make artificial photosynthesis a viable method of hydrogen generation. 5,6-dihydrothieno[2,3-d]-1,3-dithiol-2-one (α-dpdt) is a promising ligand due to its electronic similarity to previously used ligands for cobalt catalyzed hydrogen production. Dithiothiophenes have not been investigated for hydrogen production. Cyclic voltammetry experiments on [PPh4][Co(α-dpdt)2] showed reversible redox waves at -0.66 V vs. Fc+/Fc. In the presence of acetic acid, a catalytic wave corresponding to hydrogen was observed at -2.1 V vs. Fc+/Fc. Hydrogen production at an optimized pH of 4.15 was observed under light-driven conditions with [Ru(bpy)3]2+ and ascorbic acid, yielding turnover numbers as high as 300.

#45 *Spatial Analysis of Amazon Forest Fragmentation for Amazon Mammals*
Tierin Burrow-Edwards; Sarah Boyle, Department of Biology
Faculty Sponsor: Sarah Boyle, Department of Biology
Habitat loss and fragmentation is one of the greatest threats to biodiversity loss and species extinction. As globalization and global human population growth drive urbanization, and land use shifts to agriculture and development, there is a significant threat to forest habitats and the organisms that rely on these habitats. Forest landscapes provide a plethora of ecosystem services that benefit humanity (e.g. carbon storage, biodiversity preservation, nutrient cycling, climate regulation), which are degraded and/or lost through increasing habitat fragmentation as a consequence of land use change. Habitat loss and fragmentation negatively impacts species resistence and resiliency to extinction, thus there is a continual need to monitor spatial arrangements of forest landscapes in order to efficiently and effectively assess species status. The aim of this research was to utilize Geographic Information Systems (GIS) spatial analysis to quantify change in forest cover and fragmentation in the Amazon from 2000 to 2016 for placental terrestrial mammals in the Order Pilosa. This project demonstrates the utility of GIS to document, quantify, and predict species loss and shift in conservation status. Such information is critical for identifying geographic areas to prioritize for conservation management.

#46 *Design, Synthesis, and Effect of Diarylcyclopropanehydroxamic acids as Histone Deacetylase (HDAC) Inhibitors: Improving Possible Therapy for Huntington's disease*
Jeremy Thelven; Liam V. Goldman; Shana V. Stoddard, Department of Chemistry
Faculty Sponsor: Roberto de la Salud Bea, Department of Chemistry
Huntington's disease is an inherited disorder that causes the death of brain cells resulting in the degradation of physical abilities over time. This disease occurs when there is an increase of the Histone deacetylase (HDAC) enzymes. HDAC enzymes work by removing the acetyl group from the histone proteins on DNA causing the DNA to be less available to the transcription factors. Current therapeutic medication that can lessen the symptoms of Huntington's are Tetrabenazine, Diarylcyclopropanehydroxamic acids, and Antipsychotic Drugs. Previous research has displayed that through the inhibition of HDAC4 has led to improvement in motor

skill and corticostriatal synaptic function. It has been suggested through computation in previous experiments done by Dr. Shana V. Stoddard certain variations of the Diarylcyclopropanehydroxamic acids can increase the potency of inhibition of the HDAC4 enzyme. The goal of this research is to synthesize the theorized inhibitors and study the inhibition of our synthesized compound on the HDAC4 enzyme. To synthesize these cyclopropane it was found that it was more cost effective to synthesize the parts needed for the Diarylcycloprpanehydroxamic acid than to buy them.

#47 *Well-folded domains of ERAD clients influence the requirements of the ERAD machinery components for extraction to the cytosol* ◙

Candace Hayes, Christina Oikonomou, Department of Tumor and Cell Biology, St. Jude Children's Research Hospital; Dr. Linda Hendershot, Department of Tumor and Cell Biology, St. Jude Children's Research Hospital
Faculty Sponsor: Mary Miller, Department of Biology

The endoplasmic reticulum (ER) is the biosynthetic hub for membrane and secretory proteins. Even though protein synthesis is a highly assisted process, proteins that fail to mature properly must be identified by the ER-Associated Degradation (ERAD) machinery and extracted to the cytosol (retrotranslocation) for proteasomal degradation. Details on the extraction of proteins across the ER membrane and how features of misfolded clients affect their turnover have not yet been fully elucidated. We previously discovered that unfolded proteins did not need the proteasome for extraction to the cytosol. For this project, we evaluated the requirements for extraction to the cytosol for proteins that were partially misfolded but also contain a well-folded domain. We used ERAD clients which have one unfolded and one well-folded domain to study substrate movement to the cytosol for degradation. We inhibited ERAD components that were required for dislocation of unfolded proteins. Our clients were tested for 1) their ability to be extracted across the ER membrane with a de-glycosylation assay, 2) their oxidation status and 3) their ability to maintain the folded domain during ERAD. The well-folded domains did not prevent the extraction of the proteins across the ER membrane while they maintained their structure. Unlike the unfolded ERAD clients, those with a well-folded domain required proteasome activity for release from the ER. The research in this project is beneficial for understanding the basic science behind ERAD, which in turn will help to explain the mechanistic details of ERAD diseases such as cystic fibrosis.

#48 *Effect of Genetics on Neuroinflammatory Responses Following Neonatal Ethanol Exposure in BXD Mice*

Rachel Heimann, Jessica Baker; Kristin Hamre, University of Tennessee Health Science Center Neuroscience Institute
Faculty Sponsor: David Kabelik, Department of Biology

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Although entirely preventable, fetal alcohol spectrum disorders (FASD) are a leading developmental disorder, effecting 2-5% of children in the United States. There is no treatment for FASD and the severity of alcohol-induced deficits in children varies among mothers who consume approximately the same amounts of alcohol during pregnancies. Genetics have been shown to have a role in the severity of alcohol's effect on the developing brain as well as influence neuroinflammatory responses. In the present study, we aim to test whether there is an interaction between genetics and neuroinflammatory responses following neonatal exposure using C57B1/6J (B6), DBA/2J (D2) mice and previously identified BXD recombinant inbred strains that show differential susceptibility to ethanol-induced cell death in the developing hippocampus. Expression of neuroinflammatory markers were examined in the hippocampus using RT-qPCR, including Il 1β, Tnf- α, Cc12, and Il6. These results demonstrate a complex interaction between genetics, neuroinflammatory markers, and developmental alcohol exposure.

#49 *Development of antigen-specific blocking monobodies against the β2-glycoprotein I receptor for the inhibition of systemic lupus erythematosus*

Itthipoaln Rasasack

Faculty Sponsor: Shana Stoddard, Department of Chemistry

Autoimmune diseases occur when the body's immune system attacks healthy tissues and organs through the use of antibodies. Current treatments inhibit the patient's entire immune system through immunosuppressive drug therapies. These drugs decrease the body's effective immune response to genuine pathogens, increasing the patient's susceptibility to having major complications from basic infections. Therefore, treatments that can eliminate disease progression, as well as preserve the healthy portion of the patient's immune system, should be considered. The work here focuses on the development of protein monobodies capable of inhibiting interactions between the auto-antibody and autoantigen eliciting the immune response in systemic lupus erythematosus (SLE), a systemic autoimmune disorder. SLE affects a predicted 5 million individuals worldwide. An autoantigen targeted in SLE is the Beta-2-glycoprotein I receptor (B2GPI), a protein involved in blood coagulation pathways. Furthermore, it is the main auto-antigen targeted in antiphospholipid syndrome (APS), another autoimmune disorder. In silico program ROSIE was used to predict protein-protein binding scores between the monobody candidates (3K2M, 3T04, and 5A43) and proposed antibody-binding B2GPI domains 1, 2, and 5. Using in silico programs Phyre2 and Chimera, mutations to the monobody templates were introduced to improve binding between the monobody and B2GPI domains. Enzyme-linked immunosorbent assays (ELISAs) will be conducted to evaluate antibody inhibition by monobody caps in vitro.

#50 *The Galactic Wind in a Merging Starburst Galaxy*

Anna Murphree

Faculty Sponsor: David Rupke, Department of Physics

Galactic winds expel gas and dust from galaxies. Because star formation relies on the availability of gas and dust, galactic winds decrease star formation in a process of negative feedback. Integral field spectroscopy, a technique that yields a spectrum for each position in a galaxy, is a powerful tool for probing excited clouds of gas and dust. We observed the galaxy III Zwicky 35 with the Gemini telescope GMOS Integral Field Unit. We used this spectral data to analyze the dynamics and physical properties of the galaxy's outflow. The clouds of excited gas produce emission lines, from which we calculated velocities and flux ratios that give information about excitation and densities. We have found a biconical outflow that is powered by shocks and moving at velocities of over 1800 km/s. This outflow extends more than 2.5 kpc from the galaxy's disk in both directions.

#51 *Development of a 3D-printed prosthesis simulator*

Kelley Parsons, Luis Alfaro

Faculty Sponsor: Daniel Blustein, Department of Psychology and Neuroscience

Even with today's advanced technology, prosthetic limbs do not fully capture the biological capabilities of intact limbs. Battery-powered prostheses are often rejected by patients: ultimately their limitations become too burdensome for the benefit they provide. Our goal is to provide biologically-representative feedback to a prosthesis user so their device becomes a more natural extension of their own body. To test novel approaches to providing sensory feedback, we are building a prosthesis simulator which is an advanced prosthetic hand attached to a harness that can be worn by someone with an intact arm. This simulator has two main advantages: 1. Increase the size of our participant pool for research studies involving prosthesis feedback; and 2. Provide precise feedback to the intact arm in order to run carefully controlled studies exploring sensory feedback quality and position. We will present our progress in fabricating the Handi-Hand, an open-source, 3D-printed and sensorized prosthetic hand that serves as the major component of the prosthesis simulator. We will also discuss how this device will be used to test emerging prosthetic technologies that may ultimately lead to improvements in the prosthesis experience for patients with limb loss.

#52 *The role of Lrrc1 in the growth and folding of the neocortex* ◙

Claire Levesque; Jun Young Park, Developmental Neurobiology, St. Jude Children's Research Hospital; Lei Wang, Developmental Neurobiology, St. Jude Children's Research Hospital; Bryan Kuo, Developmental Neurobiology, St. Jude Children's Research Hospital; Young-Goo Han, Developmental Neurobiology, St. Jude Children's Research Hospital

Faculty Sponsor: Kelly Dougherty, Department of Biology

The evolutionary expansion and folding of the neocortex have led to significant sensory, motor, and intellectual developments in mammals. Neural progenitor cells, specifically, intermediate progenitor cells (IPCs) and basal radial glial cells (bRGs), contribute to the increased production

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of upper layer neurons and subsequent neocortical expansion and folding. Both IPCs and bRGs are produced from apical radial glial cells (aRGs), the primary neural progenitor cells. Sonic Hedgehog (Shh) signaling has been found to increase the number of IPCs and bRGs and the folding of the neocortex during development. SmoM2, a mutant Smo protein that constitutively activates Shh signaling, increases proliferation and self-renewal of IPCs, the self-renewal of bRGs, and the production of bRGs from aRGs. Despite this knowledge, the underlying molecular mechanisms that contribute to the increase in numbers of bRGs and IPCs are largely unknown. To understand molecular mechanisms of IPC and bRG expansion, we identified genes whose expression is strongly affected by SmoM2 in neocortical development. Among the identified genes, we investigated the role of Lrrc1 (whose expression is strongly upregulated by SmoM2) because Lrrc1 is a member of proteins that function in cell polarity, which critically regulates the function of neural progenitors. We investigated the role of Lrrc1 in the folding and expansion of the neocortex via loss- and gain-of-function experiments. Our preliminary data indicates that Lrrc1 does not play a significant role in either folding or expansion of the neocortex.

#53 *ALLSUP - Use of transcranial direct current stimulation of the lateral temporal cortex to improve measures of cognitive function in long-term childhood cancer survivors* ◙

Molly Litten, Kevin Krull, Nicholas Phillips, Pia Banerjee, Cynthia Jones, Jeremy Lawson, Adrienne Studaway, Amira Wassef, Sedigheh Mirzaei, Leslie Robison, Melissa Hudson
Faculty Sponsor: David Kabelik, Department of Biology

Individuals who have undergone childhood Acute Lymphoblastic Leukemia (ALL) cancer treatment see cognitive deficits that persist throughout lifetime. Studies have shown that transcranial direct current stimulation (tDCS) can aid in some of these deficits by using a very low level of constant electrical current to stimulate specific parts of the brain. A previous study showed that anodal tDCS stimulation to the frontal lobe of ALL survivors yielded improvement in these cognitive issues. In ALLSUP, cathodal tDCS suppression to the temporal lobe will be tested by targeting a different pathway that is also affected by the chemotherapy agents used in treating ALL: the hyperconnected Default Mode Network (DMN) pathway. The DMN is specifically associated with attention and working memory, so we predict that cathodal suppression to this hyperconnected pathway will reduce the activity, improving cognitive function. Subjects will be assessed by an NIH Toolbox Cognitive Battery. Our objectives are to estimate the potential efficacy for powering a larger study and to compare the effect of anodal stimulation of the frontal lobe to cathodal suppression of the superior temporal lobe on cognitive performance. We hypothesize that cathodal suppression to the left superior temporal gyrus will be associated with greater improvement in attention and working memory than anodal stimulation to the left frontal cortex in childhood ALL survivors. The results of this study will guide the further steps of appropriate interventions for these children and larger studies to determine long term effects.

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#54 *GC-MS/MS analysis of archaeological smoking pipe residues and plant material*
Lulu Schulz, Grace Tolan, Claire Rebbe, Stephen Carmody
Faculty Sponsor: Jon Russ, Department of Chemistry
Tobacco was a central feature of most Native American religious activities in the millennia before European contact. However, how and when tobacco plants (Nicotiana tabacum and N. rustica) spread from wild ancestral plants in the Peruvian Andes throughout the New World remains unknown. We are using organic analysis of residues from archaeological smoking pipes to identify the presence of tobacco using nicotine as a biomarker. Additionally, we are exploring which other plants might have been part of a smoking complex, such as amaranth, datura, etc. Finally, we are analyzing smoked byproducts from two primary species of tobacco used extensively by Native Americans in antiquity (N. tabacum and N. rustica) to determine whether we can distinguish species in archaeological residues. For these analyses, we dry and smoke plant matter using a stone smoking pipe and an artificial smoking device; the combustion residues are extracted and analyzed using gas chromatography-mass spectrometry (GC-MS), and GC-MS/MS. Furthermore, Archaeological residues are scraped from smoking pipes recovered from archaeological sites and the organic compounds are analyzed using GC-MS and GC-MS/MS.

#55 *Comparison of ultrasound bone stiffness index to x-ray bone mineral density*
Gia Pirro, Evan Main, Doni Thomas, Loukas Georgiou, Aubrey Gray, Will Newman; Brent Hoffmeister, Department of Physics
Faculty Sponsor: Brent Hoffmeister, Department of Physics
Osteoporosis is a systemic disease causing bone density to decrease and fracture risk to increase. Dual energy x-ray absorptiometry (DEXA) is the accepted technique for diagnosing osteoporosis. However, ultrasonic (US) techniques are commonly used to screen patients for osteoporosis. In addition, several new ultrasonic techniques are being developed. The present study compares DEXA measurements of bone mineral density (BMD) to US measurements of the stiffness index using a conventional clinical device. The goal is to obtain a data set that can be used for comparison to new experimental ultrasonic techniques that are being developed in our lab. Measurements were performed on 12 adult volunteers (mean age 46.5 ± 19.8). DEXA BMD measurements were performed at the hip and spine (lumbar vertebrae). US stiffness index measurements were performed on both heels. Linear regression analysis was used to determine the correlation between the US stiffness index measurements and DEXA BMD. Correlations between stiffness index (ultrasound) and BMD (x-ray) were found to fall in the range $0.2202 \leq R \leq 0.7123$, depending on anatomic location used for the BMD measurements. The results provide a basis for comparison as new ultrasonic techniques are developed and tested.

#56 *Further Synthesis toward a Polydentate Ligand for Future Catalytic Hydrogen Production*
Sam Trenner; Dana Horgen, Department of Chemistry

Faculty Sponsor: Dana Horgen, Department of Chemistry

Our target molecule, 4-trifluoromethyl-2,6-diacetylpyridine, can be used to create a polydentate ligand. Once the ligand has been complexed to a transition metal, it will be tested as a catalyst for hydrogen production. A mixture of chelidamic acid and thionyl chloride were combined, followed by treatment with methanol to afford 4-chloropyridine-2,6-dicarboxylate. This intermediate product was obtained in 27.5% yield. The product structure was confirmed by 1H NMR shifts for 2H at 7.5 ppm and 6H at 4.0 ppm. Following synthesis of 4-chloropyridine-2,6-dicarboxylate, dimethyl 4-iodopyridine-2,6-dicarboxylate was synthesized at 11.2% yield using sodium iodide then and confirmed using 1H NMR shifts for 2H at 8.1 ppm and 6H at 4.0 ppm. The next synthetic step uses copper iodide and palladium chloride in dichloromethane and FSO2CF2CO2Me in DMF to produce dimethyl 4-(trifluoromethyl)pyridine-2,6-dicarboxylate from dimethyl 4-iodopyridine-2,6-dicarboxylate. Upon synthesis of the triflouromethylated product, there is just one last reaction to synthesize the target molecule, 4-trifluoromethyl-2,6-diacetylpyridine.

#57 *Design of antibody-blocking monobodies: A novel therapeutic approach for autoimmune kidney disease*

Aryan Galani; Shana Stoddard, Department of Chemistry

Faculty Sponsor: Shana Stoddard, Department of Chemistry

Autoimmune diseases arise when antibodies erroneously attack healthy cells. Primary membranous nephropathy (PMN) is a kidney specific autoimmune disease affecting 10-12 million individuals worldwide. Currently non-specific immunosuppressants which weaken the body's entire immune system are used to treat many autoimmune disorders. These non-specific treatments decrease the patient's ability to fend off basic infections. Thus, there is a need for more targeted approaches to autoimmune diseases therapies. Therefore the goal of this project is the development of an antigen specific approach for autoimmune disease, through the design of protein monobodies capable of preventing autoantibody binding to the antigen. The PMN antigen, thrombospondin type-1 domain-containing 7a (THSD7A), was used as a target for cap development. Epitope sites were identified using an in silico homology model for the THSD7A antigen. The work here focuses on targeting two of the 17 extracellular domains which were identified to contain epitope sites, (specifically domains 9 and 10). In silico mutagenesis to the 3QHT monobody template was performed using Chimera and Phyre2 programs. Interface scores measured in Rosetta energy units (REU) were improved from -3.129 (3QHT template) to -3.927 in the 3QHT-015-AG cap. Data shows that introduction of hydrophobic residues enhanced binding. Introduction of a Phe residue, creating the 3QHT-023-AG mutant, permitted a cation-pi interaction to domain 9 of THSD7A resulting in an increased binding score of -6.617 REU. Currently protein expression and purification is underway to allow for ELISA assays and further evaluation of these epitope caps binding to domain 9 of the THSD7A antigen. Through the

development of antigen specific blocking monobodies, successful caps could provide a much safer and accurate treatment for autoimmune diseases.

#58 *Visitors' Effect on Captive Grey Wolves* ◙
Hannah Lam
Faculty Sponsor: Sarah Boyle, Department of Biology
Captive grey wolves tend to be one of the most attention-grabbing animals of zoo visitors, as zoo guests call to wolves just as they call to their domestic dogs. The purpose of this study was to observe how visitors and their actions affect captive wolves, specifically if captive wolves display natural alert behaviors towards visitors. At the Memphis Zoo, there are four grey wolf siblings of all the same age. Behavioral scans were conducted to study the effect of visitor presence, abundance, and volume on the wolves. There was a positive relationship between alert behaviors and noise volume of the visitors, but there were no behavioral changes associated with overall visitor abundance and presence. It appeared as though louder groups triggered an alert response from the wolves. It was observed that one particular wolf, the most subordinate individual in the group, showed the most alert behaviors across all three factors, which may be due to an alternating dominance hierarchy.

#59 *Assessing Stomatal Size and Density Variation Among Diploid, Tetraploid, and Hexaploid Southwestern Desert Creosote bush (Larrea tridentata) from areas of natural co-occurrence*
Ellinor Aronson, Abby Ellingwood; Robert Laport, Department of Biology
Faculty Sponsor: Robert Laport, Department of Biology
Polyploidy, the duplication of all chromosomes in an organism's genome, is an exceedingly common genomic mutation that shapes flowering plant biodiversity. A single plant species can exist as multiple ploidal races, but plants with doubled chromosome complements often differ in phenotypic traits typically associated with environmental adaptations. While prior research suggests that stomatal sizes may be larger at higher ploidies, the relationship between stomatal size and density, whole plant water use, drought tolerance, and ultimately survival in polyploid species remains unclear. The southwestern desert creosote bush, Larrea tridentata (Zygophyllaceae), is an ecologically dominant shrub comprising diploids (two copies of the genome), tetraploids (four copies of the genome), and hexaploids (six copies of the genome) that inhabit some of the most arid environments of the Chihuahuan, Sonoran, and Mojave Deserts. We collected samples of L. tridentata in areas of natural ploidy co-occurrence and took images of leaf epidermal peels from plants that differ in ploidy. To test whether stomatal size differences are associated with ploidal differences or whether such differences arise from the environmental pressures of an arid environment, we measured the stomatal size and density from images of epidermal leaf peels. We predict that stomatal sizes will increase with ploidy, but that stomatal densities will be inversely related to ploidy, resulting in similar predicted water use for co-occurring diploids and tetraploids, and tetraploids and hexaploids.

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#60 *Visual outcomes after radiation therapy for optic pathway gliomas* ◙

Sophia Quesada; Kenneth Coca, St. Jude Children's Research Hospital; Mary Hoehn, MD, St. Jude Children's Research Hospital; Ibrahim Qaddoumi, MD, St. Jude Children's Research Hospital); Thomas Merchant, DO/PhD, St. Jude Children's Research Hospital; Sahaja Acharya, MD, St. Jude Children's Research Hospital

Faculty Sponsor: David Kabelik, Department of Biology

Optic pathway glioma (OPG) often results in visual acuity (VA) decline. Radiation therapy (RT) is used to treat OPG and the effect of RT on VA is not well understood. The purpose of this study is to estimate the cumulative incidence of VA decline or improvement after RT and to identify risk factors associated with VA decline. From 1997 to 2017, 40 patients were treated with RT for OPG at a single institution and had baseline VA testing. All patients underwent serial VA testing following completion of RT. Extent of surgery was biopsy in 53% of patients and subtotal resection in 40% of patients. Approximately half the of the patients (48%) were previously treated with chemotherapy. The 3-year cumulative incidence of VA decline was 17.9% (95% Confidence Interval [CI]: 7% – 32.8%) and VA improvement was 16.3% (95% CI: 5.6% - 31.9%) for the eye with worse baseline vision. The 3-year cumulative incidence of VA decline was 13.6% (95% CI:4.8% – 26.9%) and VA improvement was 10.6% (95% CI: 2.6% – 25.2%) for the eye with better baseline vision. On univariate analysis, prechiasmatic compared to postchiasmatic tumor location increased the risk of VA decline (Hazard Ratio: 6.23, 95% Cl: 1.17 – 33.1, p=0.031). Less than 20% of patients with OPG treated with RT will experience VA decline or improvement in either eye within three years of treatment. Prechiasmatic tumors are associated with an increased risk of VA decline. Given that these patients survive well beyond their diagnosis, long-term VA surveillance is of paramount importance.

#61 *Reproductive Behavior Boldness in Female Green Anoles (Anolis carolinesis)*

Filoteia Popescu, Catherine Owen; David Kabelik, Department of Biology

Faculty Sponsor: David Kabelik, Department of Biology

The social decision-making neural network (SDMN) contains a variety of signaling neuropeptides and neurotransmitters, such as vasopressin, oxytocin, dopamine, and serotonin, as well as their receptors, which are involved in the regulation of various social behaviors, including social recognition, pair-bonding, and agonistic behaviors. 1-3 Previous studies have demonstrated that the SDMN is highly conserved across taxa, and conclusions drawn from reptile-based studies could illuminate the connection between variance within the SDMN and behavioral output.4-7 Using green anoles (Anolis carolinesis), we compare females on number and latency of behavioral reproductive expression in an effort to elucidate the connection between behavioral boldness or shyness and variance in the SDMN. Previously in our lab, we performed immunohistochemistry experiments on male green anoles in which we analyzed reproductive and aggressive trials and compared these to the distribution and baseline activation

levels of SDMN neurons. We found that sexual boldness correlated negatively with vasopressin neural counts and positively with oxytocin neural counts in certain brain regions. Based on this experiment and previous studies, we predict that sexual boldness will likewise correlate with SDMN neural connectivity and signaling in females. Since females are not studied as often and the SDMN regulates both reproductive and agonistic behaviors, this study seeks to explore whether female anoles' circuitry variation underlying boldness resembles that of males, as females do not exhibit the high levels of aggression characteristic of males.

#62 *Synthesis of Antimicrobial Peptide Analogs from Eumenes Wasp Venom*
Sakura Horiuchi, Lily North, Jeremy Thelven; Roberto de la Salud Bea, Department of Chemistry
Faculty Sponsor: Roberto de la Salud Bea, Department of Chemistry
The increase of resistance by pathogenic organisms to traditional drugs has motivated the search for new active compounds for the treatment of diseases. Currently there is a new interest for natural products as a source of potential drugs. Of these, venoms from animals and plants contain a variety of active molecules with useful and potential medicinal applications. In the venom of the Eumenes genus wasps, there are several short α-helical peptides (14 amino acids) with antimicrobial properties but since they are venom components, they also have undesired toxic activity. It is known that introducing modifications on specific positions of the primary sequence the properties of peptides can be significantly changed. By taking advantage of the already present properties of these natural compounds, our goal is to keep or even increase antimicrobial activity and reduce or eliminate their toxicity. For that purpose, we have designed a library of analogs with specific mutations on the primary structure of the natural peptides. These mutations are based on the structure given by the Schiffer–Edmundson α-helical wheel projection, which shows the secondary structure and the positions of the amino acids that can be essential for the peptide activity. In this work we will present the sequences of the designed peptides, their current synthesis and the plans for their full physical and chemical characterization as well as their antimicrobial and toxic activities tests.

#63 *DFT study of the selectivity of the β-1 adrenergic receptor* ◙
Megan Simons, Dasha Safarian
Faculty Sponsor: Mauricio Cafiero, Department of Chemistry
The β-2 adrenergic receptor signaling noradrenaline in the prostate region is necessary for activation of an angiogenic switch that induces exponential prostate tumor growth. Loss of Adrb2, the gene encoding for the β-2 adrenergic receptor, inhibits angiogenesis. This forces the endothelial cancer cells to use their own nutrients and energy, therefore halting tumor growth. This inhibition can slow down the progression of prostate cancer, which is being researched as a potential alternative to chemotherapy for cancer treatment. The structure of the β-1 adrenergic receptor with a bound partial agonist of salbutamol was used to create a model of the β-2 binding

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site. Comparing structures of a β-2 adrenergic receptor (PDB ID: 5X7D) and a β-1 adrenergic receptor (PDB ID: 2Y04) showed a pattern of binding on Chain A offset by approximately 8 amino acids in its order. The adrenergic receptor with bound ligands was optimized in this derived binding site using M062X/6-31G with implicit solvation and flexible amino acid side-chains. Interaction energies between the ligands and the receptor were calculated using M062X with the 6-311+G* basis set. Some positively charged inhibitors show results of attractive interaction energies and could be potential inhibitors for this receptor.

#64 *DFT Study of the Selectivity of Monoamine Oxidase B (MAOB)*
Audrey Woody, Samantha Jelinek; Larryn W. Peterson and Mauricio Cafiero, Department of Chemistry
Faculty Sponsor: Mauricio Cafiero, Department of Chemistry
MAOB is an enzyme located on the outer mitochondria that is responsible for degrading penylethylamine, benzylamine, and dopamine. MAOB inhibitors are generally used as a treatment for Parkinson's disease, because they stop the breakdown of dopamine. By selectively designing an inhibitor for the MAOB enzyme, the breakdown of dopamine can be reduced, thus leading to an increase of the neurotransmitter. A suite of dopaminergic derivatives have been developed as potential inhibitors of the MAOB enzyme. The inhibitory effectiveness of these dopaminergic derivatives has been measured via silico models in which the strength of interaction between each substrate and the enzymatic active site were analyzed. A crystal-structure of the MAOB active site, docked with the widely employed diabetes drug pioglitazone, was isolated from the Protein Data Bank (PDB ID: 4A79). The positions of novel dopaminergic derivatives were optimized in the active site using M062X/6-31G with implicit solvation and with flexible amino acid side-chains. Interaction energies between the ligands and the protein were calculated using M062X and MP2 with the 6- 311+G* basis set. Mutations of glutamine to histidine and glutamine to glutamic acid are being tested in order to present new information about active site behavior.

#65 *Little Glasses for Big Brains: Evaluating the Benefit of Refractive Correction and Visual Stimulation in Young Children with Cortical Visual Impairment*
Lauren Benfield; Lauren Claire Ditta, MD, Le Bonheur Children's Hospital, Hamilton Eye Institute, UTHSC, Orli Weisser-Pike, OTD, OTR/L, CLVT, SCLV, CAPS, Hamilton Eye Institute, UTHSC, Anita Mitchell, PhD, OTR, FAOTA, Hamilton Eye Institute, UTHSC
Faculty Sponsor: Alan Jaslow, Department of Biology
Cortical visual impairment (CVI) is a collection of visual deficits caused by underdevelopment or damage of the brain's visual pathways. It has become one of the most prevalent vision disorders in developing nations over the last few decades. Despite its prevalence, there are no scientifically proven treatments available to improve vision in individuals with CVI. However, a group of studies focused on visual problems in children with congenial Zika syndrome (CZS) has

shown that several patients with visual problems have no ocular problems. This suggests that there is damage to the cortical portion of the visual pathway and, therefore, these patients have CVI. These studies also demonstrated that overcorrected prescription eyeglasses significantly improve vision in the patients who exhibit no ocular problems. This suggests that overcorrected prescription eyeglasses can improve vision in patients with CVI. The current study directly tests the efficacy of overcorrected prescription eyeglasses in children diagnosed with CVI at Le Bonheur Children's Hospital and Hamilton Eye Institute in Memphis, Tennessee.

#66 *Epilepsy Surgery Outcomes in Pediatric Patients with Tuberous Sclerosis Complex*
Abigail Connor; Weatherspoon S, Rezaie R, Holder C, Choudhri A, Pounders A, Wheless J, Le Bonheur Neuroscience Institute
Faculty Sponsor: David Kabelik, Department of Biology and Neuroscience
Tuberous Sclerosis Complex (TSC) is an autosomal dominant genetic multi-organ disease that presents with neurologic manifestations in almost 75% of patients. Children with TSC under 3 years of age with any history of seizures perform worse on developmental testing than patients with no seizure history, and a higher seizure frequency correlates with poorer developmental outcomes. Infants with TSC who remained seizure free during the first year of life performed better during subsequent neuropsychological evaluations. Up to 85% of TSC patients who undergo epilepsy surgery experience a 50% reduction in seizures. Children who undergo epilepsy surgery sooner after the initial onset of seizures may show improved neurodevelopmental outcomes. We hypothesize that patients with TSC and DRE (Drug Resistant Epilepsy) who undergo epilepsy surgery during early childhood will have a reduction in their seizure frequency as indicated by ILAE (International League Against Epilepsy) surgery outcome classifications and stabilization of their developmental and cognitive sub-scores prior to and after epilepsy surgery. To further evaluate this hypothesis, a retrospective review was performed to compare the seizure frequency and neuropsychological profiles of young children (< 7 years of age) with a diagnosis of TSC before and after surgical resection of their seizure focus.

#67 *Assessing the ability of centromeric subdomains to silence genes*
Arati Joshi, Madie Holton; Bayly Wheeler, Department of Biology
Faculty Sponsor: Bayly Wheeler, Department of Biology
When a cell divides, DNA is duplicated and partitioned such that the two new cells inherit the same genetic information. Formation of a centromere, a complex of DNA and proteins, is essential for this process. Failure to form a centromere causes errors in DNA division and can cause developmental defects in humans. Heterochromatin, a condensed form of DNA and DNA-associated proteins, is necessary for centromere formation. Despite the importance of centromeric heterochromatin, how heterochromatin is established remains incompletely understood. RevCen is a transcribed DNA sequence that is present in multiple copies at the centromere and is sufficient to recruit heterochromatin and silence the expression of nearby genes. We have shown that RevCen-mediated gene silencing is partially dependent on the

presence of the RevCen promoter. The RevCen transcript contains four smaller domains, and our recent work has shown that these subdomains are insufficient for gene silencing. To test whether paired subdomains can establish gene silencing, we engineered two versions of RevCen, one that contained the first half of the transcript (subdomains 1 and 2) and one that contained the second half of the transcript (subdomains 3 and 4). We will determine if the paired subdomains are sufficient to silence gene expression. Future experiments will confirm that the loss of gene silencing is accompanied by a loss of heterochromatin. This work will demonstrate which sequences are important for RevCen's ability to silence gene expression and identify the specific components of the RevCen transcript that are necessary for heterochromatin establishment.

#68 *Comparing distributions of the neural activity markers Fos and pS6* ◙

Athena Tiwari, David Kabelik, Department of Biology
Faculty Sponsor: David Kabelik, Department of Biology

Expression of the immediate early gene c-fos has been used in scientific studies over the years as a biochemical indicator of neural activity. This gene is upregulated when neurons are activated and its gene product works as a transcription factor inside the nucleus. The presence of c-Fos protein can be detected with fluorescently labeled antibodies. In addition, recent studies have shown that ribosomal protein S6 is phosphorylated in activated neurons and can act as an indicator for translational activity in the brain. Some studies have suggested that detection of phosphorylated S6 (pS6) or related proteins may be more accurate for monitoring neural activation in particular brain regions; however, both types of tagging are currently used in research. In this study, brain slices from the lizard species Anolis carolinensis were incubated with fluorescent antibodies generated against both c-Fos and pS6. The results thus far surprisingly show a lack of overlap in cells with phosphorylated pS6 and c-Fos and a higher number of cells activated by c-Fos than pS6 in various brain regions. These findings were in green anoles euthanized under baseline conditions, but we are additionally examining the brains of green anoles participating in social interactions, as this may cause correlated upregulation of both c-Fos and ribosomal protein S6 in social decision-making network regions of the brain. The reason for non-overlapping distributions of these two activity markers are discussed.

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