



WAKE FOREST
UNIVERSITY

WAKE FOREST COLLEGE
The Undergraduate College
of Arts and Sciences

*A message from Dr. Michele Gillespie,
Dean of Wake Forest College*

Welcome to our 13th Annual Undergraduate Research Day on behalf of the URECA Center! This wonderful event encourages the sharing of ideas and celebrates our students' imagination and discovery guided by their faculty mentors. It is a pleasure to see these young scholars present their original research and creative works across all academic disciplines with the Wake Forest community.

Undergraduate Research Day is one of my favorite events on campus. It is a pure joy to walk through ZSR Library and speak with the student presenters about their projects and the different ways they have collaborated with their faculty mentors.

Today would not be possible without the support of the URECA Center, with its strong faculty board. As Dean of the College, I am always impressed by the commitment of our faculty and staff to nurture some of our best and brightest students to be such outstanding thinkers and creators of new knowledge.

Sincerely,

A handwritten signature in cursive script that reads "Michele Gillespie".

Michele Gillespie
Dean of the College
Presidential Endowed Chair of Southern History



WAKE FOREST
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Undergraduate Research and Creative Activities

**Thirteenth Annual
Undergraduate Research Day**

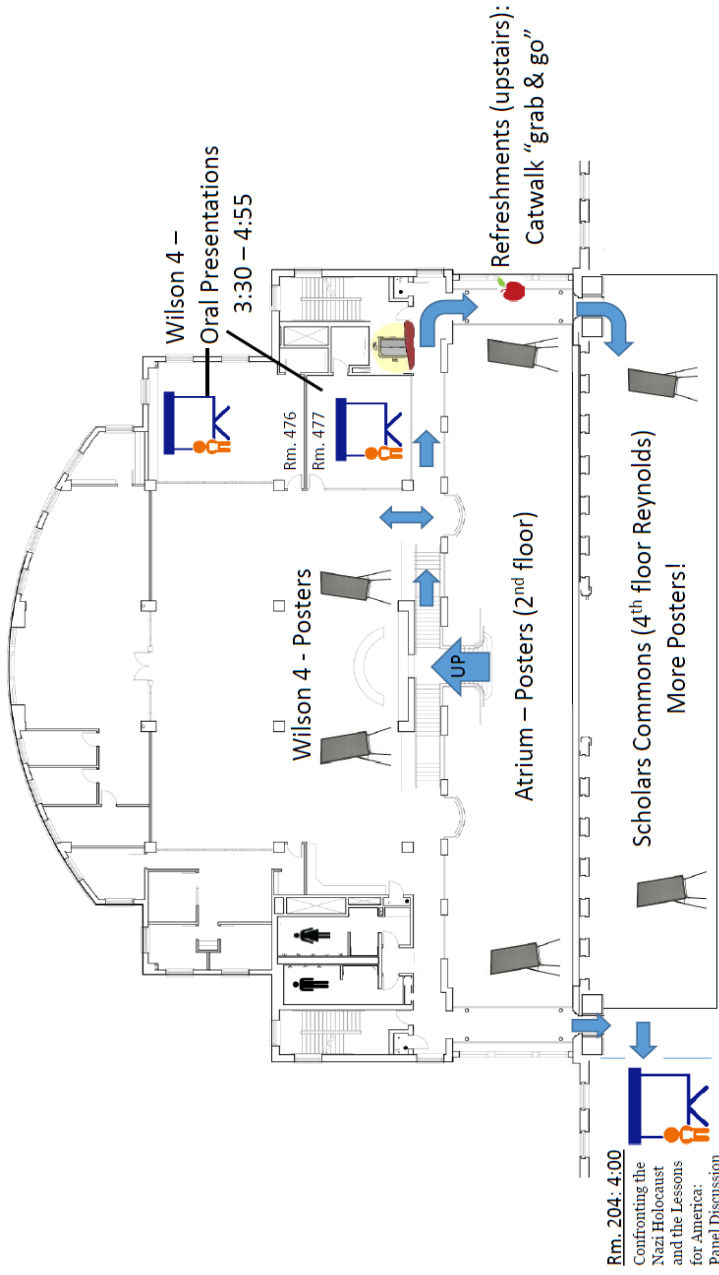
**November 1, 2019
Z. Smith Reynolds Library**

Schedule of Events

Poster Session: 3:00 – 5:00 p.m.
*Atrium,
Wilson Wing 4th floor, &
Scholars Commons*

Oral Presentations: 3:30 – 4:55 p.m.
Rooms 476 & 477

Panel Discussion: 4:00 – 5:00 p.m.
*Confronting the Nazi Holocaust and the Lessons for
America
Room 204*



Confronting the Nazi Holocaust and the Lessons for America: Panel Discussion

Z. Smith Reynolds Library, Room 204, 4:00 pm

In Spring 2019, WFU students participated in a Study Abroad course, traveling to Central Europe to compare how Germany, the Czech Republic, and Poland have contended with the memory of the Holocaust. Under the direction of Prof. Barry Trachtenberg, Rubin Presidential Chair of Jewish History and Director, Jewish Studies Program, students read scholarly and popular articles on how European countries have confronted their genocidal histories through their own national perspectives and post-war history. Students examined how the current rise of right-wing nationalism in Europe has influenced Holocaust discussions today.

Immediately prior to this trip, it was (re)discovered that WFU established its original endowment through the sale of enslaved Africans. This came after a difficult academic year in which the university's history with white supremacy was a topic of discussion and protest.

In this panel discussion, class participants Amanda Wilcox, Madison Zehmer, Morgan Milhollen, and Danny Sysler will present on how European countries are confronting the legacy of the Holocaust and possible lessons for the US in general and Wake Forest in particular as we contend with the history of American slavery and white supremacy. Research for today's presentations are supported by other students who participated in the course – Ashley Brown, Christina Griesgraber, Nick Lalli, and Nick Karras.

NOTE: This study abroad experience was sponsored in part by the Wake Forest University Humanities Institute, with support made possible by a major grant from the National Endowment for the Humanities. Any views, findings, conclusions, or recommendations expressed in this panel discussion do not necessarily represent those of the National Endowment for the Humanities.

Oral Presentations
Session A
Room 476 ZSR Library

3:30-3:40 Andrew Logan

Operationalizing Gross National Happiness

3:45-3:55 Kylie Reed

Change in Quantitative Computed Tomography-Derived Cortical and Trabecular Bone Compartments after Sleeve Gastrectomy

4:00-4:10 Nicole Rogers

Head Kinematics in Rodeo

4:15-4:25 Elijah Shalaway

Sports and Literacy: An Analysis of Scholarship since Title IX

4:30-4:40 Bifeng Xu

Tucker Decomposition on High Dimension Neural Activity Tensors

Faculty Moderator:
Dr. Kristen Beavers
Assistant Professor
Department of Health and Exercise Science

Oral Presentations
Session B
Room 477 ZSR Library

3:30-3:40 Ellie Bruggen

The Role of Women in Spain's Farm Tourism Industry

3:45-3:55 Emelyn Hatch

A Durus Circulus: Farmer, Nature, & Civil Conflict in
Vergil's Georgics

4:00-4:10 Andrew Murphy

The Edgeworth Letters and Late-Enlightenment
Education

4:15-4:25 Katherine Quinn

Finding Friends as a Foreign Fiddler: Characteristics
of Open Music Sessions in Ireland and Scotland

4:30-4:40 Jacob Thomas

Art and Cultural Continuity in Chile: Mapuche
Creative Rhetoric

Faculty Moderator:
Dr. T.H.M. Gellar-Goad
Associate Professor
Department of Classical Languages



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Undergraduate Research and Creative Activities

**Thirteenth Annual
Undergraduate Research Day**

November 1, 2019

**Abstracts of
Research Activities**

(Alphabetical order)

Oral Presentations Pages 10 – 19

Poster Presentations Pages 20 – 151

(Students listed without a poster # are not present due to previously approved obligations.)

The Role of Women in Spain's Farm Tourism Industry

Ellie Bruggen

Major: Politics and International Affairs

Mentor: Peter Siavelis, Politics and International Affairs

Combining an interest in gender, rural development, and the power of stories, this study examined the role of women in Spain's farm tourism industry and their empowerment, or lack thereof, in a patriarchal society. Responding to needs for economic diversification, farm tourism has expanded as an industry that provides visitors with idyllic countryside escapes featuring horseback riding, gastronomy, and local activities. My project led me to five farm tourism sites in Spain. Through observation and interviews with proprietors, professors, and other stakeholders, I concluded that the role of women is multifaceted. It is also simultaneously empowering and disempowering. In some ways, the industry gives women greater autonomy and a way to generate disposable income. On the other hand, the domestic chores accompanying farm tourism can further entrench gender roles, given that in most cases women cook and clean more than their husbands. Each individual presented a highly nuanced perspective of the farm tourism industry and her role within it. However, the majority of women noted that while they feel more empowered than their parents' generation, machismo persists in evolving ways. The inherently subjective and ever-changing notions of sexism, gender, and empowerment cannot be well generalized nor confined; they mandate infinite investigation from all fields and perspectives, and they require deep, compassionate conversations. These enriching dialogues formed one of my most salient takeaways from this experience; we simply cannot forget that every theory and policy that we vehemently debate should be rooted in the diverse human lives whom they affect.

A Durus Circulus: Farmer, Nature, & Civil Conflict in Vergil's Georgics

Emelyn Hatch

Major: Classical Languages (Latin)

Mentor: T.H.M. Gellar-Goad, Classical Languages

I analyze the vocabulary of fertility and barrenness in Vergil's *Georgics* in order to examine the relationship the poem establishes between humankind and nature. I first define and catalogue adjectives that convey fertility and barrenness in the *Georgics*, providing an overview of their various functions in context. I then proceed to argue for the centrality of one of these words, *durus* (meaning "hard," "harsh," "uncultivated"), more so than words of fertility, to characterizing the relationship between humankind and nature and creating a recurring, cyclical impression of violence and civil war throughout the poem. Finally, I interrogate the utility and morality of the poem's depictions of human expressions of *duritia* – namely warfare and sacrifice. Although the ostensible project of the *Georgics* as it is outlined in the first lines of the poem is to explain how the farmer may bring about productivity in his environment, I show that the poem succeeds in portraying the relationship between farmer and nature not as one of fertility or abundance but as one of barrenness that comes as a consequence of violence and civil war.

Operationalizing Gross National Happiness

Andrew Logan

Major: Mathematical Economics

Mentor: John Dalton, Economics

Bhutan is the first country to design economic policy around the maximization of Gross National Happiness (GNH) in lieu of per capita GDP. This has generated a great deal of international attention – around the world, GNH is being heralded as a revolutionary development paradigm that can and should displace development economics' focus on the maximization of per-capita GDP. Lost in this GDP vs GNH debate is a discussion of the tangible differences between policy outcomes dedicated to maximizing GNH as opposed to those that seek to maximize GDP. This paper initiates such discussion by examining how GNH has been operationalized in the Bhutanese economy. It finds that Bhutan's economic planning body designs policy around the achievement of orthodox economic targets in line with the logic of GDP and retroactively justifies that they were designed with the intention of maximizing GNH. This disconnect between the rhetoric and reality of GNH is the result of a lack of a common definition of GNH across different bureaucratic organizations in Bhutan.

The Edgeworth Letters and Late-Enlightenment Education

Andrew Murphy

Major: English

Mentor: Jessica Richard, English

The Maria Edgeworth-Rachel Mordecai correspondence held in the Southern Historical Collection at the University of North Carolina is an interesting artifact of Irish and American intellectual history, as Edgeworth was one of the most famous authors of her time and Mordecai a middle-class American woman with no literary aspirations. The correspondence between the Anglo-Irish Edgeworth and the Jewish American Mordecai reveals a powerful story about religious tolerance and education – one which has been largely ignored despite its importance to history. Materials such as a pencil drawing of Edgeworthstown House (the Edgeworth family’s ancestral home) communicate ideas about education and the system of “accomplishments” while facilitating interaction across the Atlantic Ocean. The letters themselves shed light on a friendship between two women who never met each other in person, but who enjoyed a relationship that lasted over twenty years. Accomplishment (by which is meant drawing, playing an instrument, speaking French, dancing, etc.) and science are among the most interesting subjects of the letters, and are the focus of this paper. Many of the letters were sent with samples of plants, illustrating a scientific exchange between the United States and Ireland and the Enlightenment educational ideology which encouraged such exchange. The drawing and the plant samples, in particular, offer us an excellent view of how education and ideology were integrated into everyday discourse at the end of the long Eighteenth Century.

Finding Friends as a Foreign Fiddler: Characteristics of Open Music Sessions in Ireland and Scotland

Katherine Quinn
Major: Psychology

Mentor: E. J. Masicampo, Psychology

Music provides a community for similarly-passioned individuals. Some music cultures are exclusionary towards newcomers wanting to join pre-existing groups. Others have inclusive music settings available. What makes the inclusive spaces so different from the exclusive ones? By observing open music sessions in Ireland and Scotland, this research aims to lessen the information gap on components of inclusive music settings and their cultural implications. A total of 40 music venues were observed (24 Irish and 16 Scottish), for instruments, characteristics of the physical space, and demographics and interactions between musicians and the audience. Statistical analyses found only five significantly distinct variables with $p < 0.05$ among the 35 chi-square tests of independence. Compared to Scotland, Ireland was more likely to have accordions, flutes, whistles, solo ballad singers, and a dance floor. This may suggest a cultural difference of popularly used instruments, the importance of ballads, and the prevalence of dance. It is inconclusive as to what variables clearly contribute to the inclusivity of these music environments. Loose trends in space allocation and social interaction may suggest a balance between offering an intimate feel for the audience and ensuring respect for the musicians in Irish and Scottish culture. Future research is needed with a larger and more robust sample with more observable variables of space characteristics, demographics of musicians and audience, and their social interactions.

Change in Quantitative Computed Tomography-Derived Cortical and Trabecular Bone Compartments after Sleeve Gastrectomy

Kylie Reed

Major: Health and Exercise Science

Mentor: Kristen Beavers, Health and Exercise Science

Background: Most studies evaluating surgical weight loss associated bone loss use dual energy x-ray absorptiometry (DXA) acquired areal bone mineral density (aBMD). Less susceptible to artifact than aBMD, volumetric BMD (vBMD) acquired by quantitative computed tomography (QCT) allows for measurement of trabecular and cortical bone. Robust assessment of compartmental bone change provides insight into the biology of surgical weight loss associated bone loss.

Methods: Data comes from an ongoing pilot RCT (NCT03411902) examining use of oral bisphosphonates as a counteractant strategy to surgical weight loss associated bone loss. Single energy helical CT scans of the hip (superior acetabulum to mid-femur) were collected at baseline and six months (Siemens SOMATOM Definition Flash dual source CT scanner; Siemens Healthcare). Total hip (TH), femoral neck (FN), and trochanter (TR) cortical and trabecular vBMD were quantified using QCTPro (Mindways Software, Inc., Austin, TX).

Results: Data collection is ongoing. Baseline demographic data are available for 24 individuals (age: 56 ± 6.7 years, 83% female, 21% black, BMI: 44.8 ± 6.1 kg/m²); 6-month vBMD data are available for five participants. Among participants with follow up data, weight loss at six months was $-15.7 \pm 5.5\%$. Trabecular vBMD declined at the TH ($-2.1 \pm 5.7\%$), FN ($-3.1 \pm 9.5\%$), and TR ($-2.9 \pm 3.3\%$). In contrast, cortical vBMD increased at the TH ($+2.7 \pm 4.4\%$), FN ($+1.8 \pm 8.1\%$), and TR ($+2.5 \pm 8.4\%$).

Conclusion: Initial estimates suggest that trabecular vBMD consistently decreases at the TH, FN, and TR while cortical vBMD increases. Future analyses will assess compartment specific changes in the entire study sample and treatment effects on CT-derived metrics of bone health.

Head Kinematics in Rodeo

Nicole Rogers

Major: Health and Exercise Science

Mentor: Joel Stitzel, Virginia Tech / Wake Forest School of Biomedical Engineering and Sciences

Concussions account for 12.8% of rodeo injuries, and rodeo athlete's heads are often unprotected and exposed to a unique loading environment often coming in contact with the ground, the animal, and/or the perimeter of the arena. The objective of this study was to pilot a mouthpiece-based sensor in rodeo to measure head kinematics associated with typical rodeo events. A custom mouthpiece with an accelerometer and gyroscope was deployed in a rodeo athlete during two horse riding sessions, two roping events, and two bull riding events. Head kinematic data, including linear and rotational acceleration, and rotational velocity at the head center of gravity were analyzed alongside time-synchronized video footage to determine how the movement of the animal corresponded to head kinematics of the athlete. During bull riding events, linear accelerations ranged from 2.0 to 13.3 g when the animal contacted the ground. Linear accelerations during roping events ranged from 2.5 to 7.6 g when the equine pushed off their back hooves. During equine practice sessions, average linear accelerations corresponded to the horse's gait, resulting in 1.1, 2.4, and 2.5 g for walking, trotting, and loping, respectively. Furthermore, the subject received direct head contact following a fall during bull riding, resulting in peak resultant linear acceleration of 24.8 g. Results demonstrate that rodeo athletes are exposed to wide ranges of head accelerations during normal participation of the sport that correspond to the animal's movement. This pilot study provides a framework for future research and yielded the first head kinematic data in rodeo.

Sports and Literacy: An Analysis of Scholarship since Title IX

Elijah Shalaway
Major: English

Mentor: Alan Brown, Education

This research idea was inspired from the book *Developing Contemporary Literacy through Sports: A Guide for the English Classroom* by Alan Brown and Luke Rodesiler. The purpose of this study has been to investigate how and why secondary teachers of literacy and English language arts account for students' interests in sports and sports culture, as documented in peer-reviewed academic journals from 1972 through 2018. Two basic questions guided this project: (1) Based on a review of peer-reviewed articles published since the enactment of Title IX in 1972, how do secondary teachers and teacher educators account for students' interests in and knowledge of sports and sports culture in the English language arts classroom? (2) Based on this review, how do secondary teachers and teacher educators rationalize their decisions to incorporate or not incorporate sports in the English language arts classroom? Across five academic journals containing 4700+ articles, the study has found hundreds of articles articulating the benefits of sports-related content in the English language arts classroom. The greatest trend to date relates to the reading and writing interests of K-12, which include popular sports such as baseball, soccer, football, and basketball. For instance, one article examines a student who refused to read. Once the teacher noticed his interest in soccer and providing him with further reading about the sport, he began to participate in class and asked for more books. This is just one example of the positive impact sports literature can have on students.

Art and Cultural Continuity in Chile: Mapuche Creative Rhetoric

Jacob Thomas
Major: Spanish

Mentor: Andrea Echeverría, Spanish and Italian

The occupation of indigenous Mapuche land in the Southern region of Chile precipitated a forced emigration of Mapuche people to Santiago for economic incentive. This transition facilitated creative rhetoric that illustrates the political nuance of this migration. Contextually, the political organizing of Mapuche people in response to legislative and military developments underpins the rhetoric of demands for Mapuche rights and land acknowledgements. In Santiago, I wanted to investigate how migration ultimately contributed to a new understanding of Mapuche identity that factors into contemporary modes of cultural continuity. Through qualitative analysis, by attendance and evaluation of manifestations of cultural continuity and preservation in the city, I examined the ramifications of this migration on a new understanding of Mapuche identity. This analysis determined many demonstrations of Mapuche cultural continuity and rhetoric in Santiago are rooted in efforts towards just treatment, autonomy, and the significance of land acknowledgement in Southern Chile. In contemporary Chile the advent of Mapuche poetry, film, and theater in Santiago follow these themes of cultural continuity harkening back to the historical context of occupation and oppression of the nineteenth and twentieth centuries.

Tucker Decomposition on High Dimension Neural Activity Tensors

Binfeng Xu

Major: Computer Science

Mentor: Grey Ballard, Computer Science

We implemented Tucker Decomposition on a huge set of neural activity data and made it possible to compute the reduced distance matrix from voxel based brain data through High Order Singular Vector Decomposition. Then we experimented multiple techniques in both supervised and non-supervised learning to compare regression and clustering performance of processed matrix from voxel and regional based neural data, trying to discover advantages of voxel based data, which encodes brain activity in higher specificity, over its regional based counterpart. For example, SMOTE for oversampling imbalanced labels, UMAP for neighbor graph dimension reduction, and multiple regression models such as Random Forest, SVM and GBDT. The results are biased -- there is no unique pattern that indicates voxel based data results in higher performance in all tasks. However, the techniques used for decomposing TB-level tensors and experimentations on regional vs. voxel based data tradeoff are valuable and deserve further exploration.

Poster #1

How Should We Think About Race within Institutions?

Kyle Adams

Major: Philosophy

Mentors: Dean Franco, English and Tom Phillips, Wake Forest Scholars

Over the course of two months, I interned at the Institute for African Alternatives (IFAA), a research institute in Cape Town, South Africa that focuses on political economy, social theory, and philosophy of race. I worked directly under the guidance of Deputy Director Michael Nassen Smith as well as Director Ben Turok. During my two-month stint, I researched the concept of "rainbowism" – the concept that South Africa can exist as a pluralistic society that celebrates the various cultures and identities within the country's borders. The namesake of the concept comes from the colorful post-apartheid national flag of South Africa, which led South African government leaders like Nelson Mandela to declare the country to be a "rainbow nation." My research explores the downstream effects of such political, institutional rhetoric on the future of racial equity.

I examined the efforts of universities in both South Africa and the United States to confront troubled histories with slavery, institutional racism, and the other forms of discrimination that have historically plagued campuses. The efforts that I researched begin with Brown University's 2006 report on Slavery and Justice and work up to the present day with Wake Forest's President's Commission on Race, Equity, and Community.

Poster #2

Study on the Psychological Effects of Child Sexual Abuse and the Tradeoffs between Prosecution and Victim Recovery

Amber Adkins

Major: Psychology

Mentors: Tess Chevalier, Psychology and Tom Phillips, Wake Forest Scholars

In 2017, the Children's Bureau of the U.S. Department of Health and Human Services found the state of Kentucky to have one of the highest rates of child sexual abuse (CSA) in the country. This study aims to give a holistic view of the effects of CSA on its victims, the processes which are currently in place in Kentucky to deal with the aftermath of CSA, and improvements which could be made to these systems so as to lessen the negative psychological effects on children while increasing the prosecution rates of their perpetrators. Through archival research looking at previous studies on the psychological effects of CSA, as well as observations at the Children's Advocacy Center of the Bluegrass (a non-profit organization dedicated to lessening the trauma experienced by child victims of sexual abuse), it was found that these issues are highly complex. Although there are changes which could be made in order to increase the prosecution rates of the perpetrators of CSA, overall it was found that prosecution may not always be what's best for the victim.

Poster #3

An Exploration of Contemporary Afro-German Activism

Cameron Allen

Major: Politics and International Affairs

Mentor: Molly Knight, German and Russian

This paper aims to examine the impact of various mechanisms of social activism by exploring the contemporary Afro-German Movement. Through a historical analysis of the strategies employed by the founding activists of the Afro-German Movement in the 1980s, a standard measure of cultural implications and social progress was established. The contemporary matters of social justice in the Afro-German Movement include the diversification of public images and monuments to promote inclusivity, the depletion of street namesakes of historical leaders of racially or ethnically driven crimes, and the improvement of progressive legislation. The collected data encompasses literary accounts, artifact analysis, primary publications, images, and monuments. This report is part of a growing body of research on the present-day consequences of racial cleansing practices leading to the end of World War II. In addition, original poems are included in the report as a byproduct of writing workshops that emphasized telling one's story with an authentic voice. The work of contemporary Afro-German Activism relies on literature and artistry to effectively portray sentiments and maintain a record of social progression. In analyzing literature as a source of activism, a very common source of self-expression, this project will contribute to future research of similar projects.

Poster #4

Understanding the Experience of Homelessness: An Exploration of Winston-Salem

Zakary Amen

Major: Anthropology

Mentor: Sherri Lawson Clark, Anthropology

This project explores homelessness through the experience of two Winston-Salem individuals and larger aid organizations during the summer of 2019 in the city of Winston-Salem following the conclusion of the ten-year plan to end homelessness. Historically, these quantitative findings have depicted that housing is the most crucial aspect in the fight to end homelessness. I use two major research strategies: (1) a qualitative analysis of the experience of homelessness by two Winston-Salem individuals and (2) a quantitative and spatial analysis of demographics that impact homelessness. Participant observation, semi-structured interviews, free lists, card sorting, and community mapping contributed to the collection of qualitative findings. Quantitative data was collected from archives, reports, and the U.S census. This project highlights some of the shortcomings, such as limited numbers of low- or no-income housing and poor organization of the voucher system, in regard to the relationship between homeless individuals and case workers of the housing-first initiative in Winston Salem. The project discovered a disconnect in communication between homeless individuals and aid organizations revolving around the creation of an identity separate from homelessness. This project hopes to promote further work in understanding the multiple facets that contribute to homelessness in Winston-Salem and motivating policymakers to approach the issue from a more holistic lens.

Poster #5

Neural Indicators of Social and Emotion Regulation

Grace Anderson

Major: Psychology

Mentors: Bethany Teachman, Psychology (University of Virginia) and James Coan, Psychology (University of Virginia)

Emotion regulation is the process by which individuals manipulate the experience and expression of their emotions, with the purpose of downregulating negative emotion. Most people use a variety of emotion regulation strategies in different situations, but the present study focuses on two contrasting strategies: cognitive reappraisal and expressive suppression. Cognitive reappraisal involves engaging with emotions to think more positively, while expressive suppression involves inhibiting the behaviors associated with emotions. Social regulation is the process in which the presence of trusted others helps moderate one's emotional experience. It is known that emotion regulation strategies and social regulation work together to help individuals downregulate negative emotional experience. The goal of the present study is to analyze the interaction between emotion regulation and social regulation on neural response to an ambiguous threat, such as threat of shock. Participants (N = 72) were assigned to one of three conditions: alone, handholding with a stranger, and handholding with their romantic partner. Then, participants were exposed to the threat of an uncomfortable, but not painful, shock to the ankle. It was predicted that: 1) individuals who regularly engage in cognitive reappraisal will have less activity at P300, a specific event-related potential (ERP), than individuals who regularly engage in expressive suppression 2) individuals holding hands with their partners would have less activity at P300 than individuals who were alone or with a stranger 3) and that individuals who both regularly engage in reappraisal and held hands with their partners would have the lowest activity at P300.

Poster #6

An American Artist

Olivia Andreini

Major: Art History

Mentor: David Lubin, Art History

I explored the works of 19th and 20th Century American artists: Augustus Saint-Gaudens, N.C. Wyeth, Edward Hopper, and Jackson Pollock. Specifically, I took an interest in how these entirely independent artists engaged with the conditions of their times. Although it is common for art to indirectly (if not unknowingly) reflect cultural and historical movements, each of the artists studied in this research exhibited an extended consideration of the overarching American tone at the time that they worked.

Augustus Saint-Gaudens, in his monumental relief, *The Shaw Memorial*, depicted and personified a nation wounded by racial fissures. N.C. Wyeth composed his illustrations for the classic story, *Treasure Island*, with a 'nervousness' that plagued late 19th Century America. Edward Hopper, in his deceptively light-hearted pictures, exposed a widespread post-war loneliness of the common American. Jackson Pollock's art and portrait were splattered across *Time Magazine*, making the creative-genius, tortured-artist, bad-boy type a common household name in midcentury America.

Saint-Gaudens, Wyeth, Hopper, and Pollock were entirely distinct from one another in time, technique, and subject matter. Despite their discrete surroundings, each artist contemplated and captured the underlying temper of the America that surrounded them. This project communicates a nuanced and multidimensional examination of each artist and the nation in which they worked.

Poster #7

Indonesian Political Identity and Preference

Luke Baker

Major: Politics and International Affairs

Mentor: Nelly Van Doorn-Harder, Study of Religions

This past summer I traveled to Yogyakarta, Indonesia for one month to investigate how political identity and preference is formed among young Indonesians. Indonesia is a vastly diverse country that encompasses over 17,000 islands which are home to hundreds of different ethnic and linguistic groups. Indonesia is home to the largest Islamic population in the world with 225 million Muslims making up around ninety percent of the population. Even with this tremendous diversity, Indonesia has remained a stable democracy with five peaceful transfers of power after democratic elections since 1998. In April 2019, Indonesia held the world's largest direct presidential election with the incumbent Joko Widodo being elected to a second term.

Yogyakarta is known as the "city of students" and is home to several prestigious Indonesian universities that host students from across this diverse country. Through interviews and discussions with students and professors, I was able to conclude that while Indonesia's population is clearly comprised of clear majority in both religion and ethnicity with the Muslims and Javanese, Indonesians today are committed to upholding the democratic ideals that value diversity which were first introduced during the country's inception. The value of "Unity in Diversity" and a pluralistic national philosophy continues to define Indonesia politics today.

Poster #8

Spanish Dichotomies: Reevaluating the Teaching of *Ser/Estar* and *Preterite/Imperfect* in Beginner-Intermediate Textbooks

Madeline Barnes

Major: Spanish

Mentor: Luis González, Spanish and Italian

Spanish has several dichotomies that are challenging for non-native speakers, such as *ser/estar*, *por/para*, *preterite/imperfect*. These distinctions are often taught in textbooks with eight to fifteen rules for each dichotomy. Most of those rules are half-truths, as Frantzen (1995) shows. Scholars have proposed to merge those sets of rules into more encompassing principles.

My study explored the sets of rules and the encompassing principles for *preterite/imperfect* and *ser/estar*. The goal was to explore how to integrate the scholarly explanations in textbooks. *Preterite* expresses that the participant enters an interval or leaves it (entering/leaving a room is a metaphor accessible to college and high school students). *The imperfect* expresses that the participant is in the interval (stays in the room). *Estar* expresses a change of state. *Ser* is used if no change is expressed.

In addition to showing that the principles cover all of the rules in textbooks, I also propose how to change or adapt textbook exercises, so the explanation is better understood, practiced, and reinforced. Observe how *estar/ser* can be grasped through well-chosen examples:

<i>ESTAR</i> (Change of state)	<i>SER</i> (No change)
<i>El gato está muerto</i> [the cat is dead]; <i>el gato está afuera</i> [outside]; <i>el gato está vacunado</i> [vaccinated]; <i>el gato está jugando</i> [playing].	<i>El gato es nuestro</i> [ours]; <i>el gato es hijo de Canela</i> [the son of Canela]; <i>el gato es un gato doméstico</i> [a domestic cat]; <i>el gato es angora</i> [Angora]; <i>el gato es de Rosa</i> [the cat is Rose's].

Poster #9

Rising China and South Asia's Geostrategic Realignment

Yabsera Bekele

Major: Politics and International Affairs

Mentor: Neil DeVotta, Politics and International Affairs

China has expanded its influence across the South Asian region over the past decade. China and India share a disputed border that is 2,100 miles long, which led to a war in 1962. Today, India and China increasingly cooperate with one another, but China's Belt and Road Initiative (BRI), incorporating South Asian states, is causing tension and competition between the two countries.

To what extent is China's expanding influence in South Asia undermining India's regional dominance? Furthermore, could this lead to another military conflict between the two Asian giants? To better understand this issue, I traveled to Sri Lanka, Bangladesh, and Nepal to interview academics, students, former ambassadors, and think tank experts. India is very wary of Chinese investments within these "small brother" countries as China uses these investments to further its strategic interests. My findings show that all three countries have different views of China's activities, depending on historical ties, economic productivity from projects implemented, and opportunities created as a result of the BRI.

The unfolding relations between China and South Asian countries arguably reflect similar concerns about the BRI in other areas of the world.

Poster #10

Crises of the Republic? 1799 and 2019, Examined

Jack Beyrer

Major: History

Mentor: Jake Ruddiman, History

T.S. Eliot once proclaimed, "There is no such thing as a Lost Cause because there is no such thing as a Gained Cause." Gazing back to 1799, this adage seems to be true. Using the discipline of applied history, this project examines relationships between domestic political actors and the international order in both 1799 and in the current day – a competition of causes neither lost nor gained. The tripolar security dilemma America faces with the Chinese and Russian revisionist great powers maps strikingly onto the situation America faced in 1799 with France and Britain. Intense domestic politics mark both cases. This prompts the question: In 1799 and 2019, are there crises of the Republic? This paper endeavors to explain why, despite our modern foibles, the circumstances of 1799 were far more dire.

Poster #11

The Effects of Climate Change on Wine Production in Burgundy, France

Sarah Dancy Blackburn
Major: French Studies

Mentor: Kendall Tarte, French Studies

This 2019 Richter scholarship project examines the effects of climate change on wine production and the influences of the restrictive wine laws in the Burgundy region of France. According to French law, bottles are labeled by region, or “appellation”. Burgundy has over 100 appellations, mostly produced by the Chardonnay and Pinot Noir grape varieties, that have been classified on the World Heritage list since 2015.

My research focused on the future of French wine production and the urgency of climate change within the industry. Through the Rotary Club of Mâcon, I was able to interview wine professionals, including those involved with appellation legislation and a winemaking technician within the Ministry of Agriculture who specializes in climate change studies. This gave me the opportunity to analyze multiple perspectives on the future of Burgundy wine production. Through interviews, I found that the climate is causing many changes to the plants and grapes themselves in Burgundy. However, I also discovered that while researchers and winemakers are working to find solutions for such developments, French appellation law has yet to accept that changes to winemaking tradition is necessary.

Poster #12

The Tale is in the Tools: Analyzing the Stone Artifact Assemblage found at Espadanal, Portugal

Zachary Boal

Major: Anthropology

Mentor: Paul Thacker, Anthropology

Espadanal is the only multiple occupation open air Upper Paleolithic archaeological site located on a floodplain in central Portugal. Analyzing this site is important for understanding the way in which Ice Age hunter-gathers lived and moved on the land. My project's lithic assemblage analysis investigated the technological organization and typology of tools found while also utilizing a framework for understanding prehistoric raw material selection practices. The abundance and diversity of retouched tools at the site, in addition to the extensive core maintenance and tool sharpening strategies support the hypothesis that Espadanal was a medium-duration campsite during the Magdalenian. Despite the close proximity to the Azinheira Ridge chert source and in contrast to the Early Upper-Paleolithic levels of the site, hunter-gathers during the Magdalenian at Espadanal did not perform the early stages of core reduction or create large tool blanks. Instead, artifact use-life practices and debitage analysis indicate the transport and conservation of chert tools and finished cores to the campsite, supplemented by the use of quartz raw material cobbles available on-site. This raw material conservation during the Magdalenian assemblages indicate a highly mobile settlement pattern in central Portugal following the Last Global Maximum.

Poster #13**Effects of Nitroxyl on Formaldehyde Cofactors**

Callum Brazier

Major: Medicinal Chemistry

Mentor: S. Bruce King, Chemistry

Nitric oxide (NO) is a known gasotransmitter first recognized as a toxic component in air pollution, but later found to have biological properties. The molecule nitroxyl (HNO) is similar to NO but differs in the addition of one hydrogen atom. This slight deviation gives nitroxyl a unique chemical/biological profile in comparison to NO. Based on previous research, nitroxyl behaves in a similar way to that of formaldehyde (CH_2O) due to both molecules acting as good electrophiles. Since formaldehyde participates in many normal metabolic processes mediated by enzymes containing the co-factors like tetrahydrofolate, the purpose of this research was to determine whether nitroxyl reacts similarly as formaldehyde with these known cofactors. First, nitroxyl donor molecules were synthesized because nitroxyl dimerizes to produce N_2O . Angeli's salt and nitrocyclohexyl acetates were synthesized and tested through gas chromatography to measure levels of N_2O . These donors were then reacted with a secondary amine to observe the products made. Secondary amines were chosen because this functional group is present in cofactors of formaldehyde metabolism. Treatment of pyrroline compounds (secondary amine) with nitroxyl yields 1,3-butadiene and 2,4-hexadiene (identified through gas chromatography/mass spectrometry), which occurred through a secondary nucleophilic amine attack on the electrophilic nitrogen of the nitroxyl molecule.

From this reaction mechanism, it is likely that nitroxyl reacts with the secondary amine(s) present in tetrahydrofolate and folic acid via the same or a similar pathway. Further studies can be conducted by reacting nitroxyl with other cofactors of formaldehyde and observe the produced results through mass spectrometry.

Poster #14

How do earthworms taste? A study of appetitive chemoreception.

Haley Buggy (co-presenting with Sydni Hill)

Major: Biology

Mentors: Cecil "Jake" Sanders, Biology and Wayne Silver, Biology

Soil conditions are key to the health and survival of our planet and its inhabitants. An essential, but often overlooked, player in soil conditions worldwide are earthworms. In this subterranean environment, earthworms rely on their chemical senses to make decisions about how they will interact with the world around them. However, little is known about what chemicals attract earthworms. In this project, the European nightcrawler (*Eisenia hortensis*) is used as a model organism to investigate appetitive and aversive stimuli. Researchers in this lab previously developed an assay for testing aversive stimuli. For example, we know that earthworms are aversive to NaCl and AITC. Our work has largely been focused on developing an assay for presumably appetitive compounds like glutamate. Previous research has indicated that earthworms feed on microorganisms in the soil. Therefore, we were interested in investigating bacteria as a potentially appetitive stimuli. In this experiment, we culture bacteria from the crop and gizzard of *E. hortensis*. Cultures of this (presumably consumed) bacteria were then used in our appetitive assay to test if it was an earthworm attractant. Our work thus far has yielded an assay for identifying appetitive compounds and has begun to illuminate the influence of bacteria on earthworm behavior. Identifying compounds that are appetitive to earthworms could be used to attract earthworms to rehabilitate polluted soil.

Poster #15

German Queer Public Histories

Sunny Calhoun

Major: Women's, Gender, and Sexuality Studies

Mentor: Molly Knight, German and Russian

LGBTQ+ public history sites are often contested spaces, where proper identity labels and historical accounts are difficult to render in terms of modern understandings and discourses. However, this conversation is important for advancing understanding and visibility of queer histories worldwide. In the Germanic context, public history sites tell an important story about the oppression of LGBTQ+ people spanning from the early 19th century through the fall of the Berlin Wall.

This research elevates this history by providing a new and globally accessible public history resource with the purpose of promoting visibility and transparency about the queer experience in 19th and 20th century Germany. Through the creation of an innovative and informative website with interactive maps and translations, my research makes accessible important historical sites that commemorate the oppression and resilience of LGBTQ+ individuals. Focusing on a wide history ranging from the inclusion of a provision in the German Criminal Code establishing homosexuality as illegal, to the persecution of homosexuals during the Holocaust, to the oppression felt later in the divided Germany of the Berlin Wall, the monuments I have documented aim to create collective memory of a Germany deeply engaged with questions of the responsibility to commemorate LGBTQ+ histories.

Poster #16

Evaluation of Subjective and Objective Measurement Tools in Assessing the Physical Activity Level, Cardiorespiratory Fitness, and Lifestyle Classification of Children and Adolescents

Natalie Campisi

Major: Health and Exercise Science

Mentor: Peter Brubaker, Health and Exercise Science

Introduction: The overweight and obesity epidemic has become an extreme issue in Israel and other countries across the world. The Health and Sports Clinic for Obese Children at the Baruch Padeh Medical Center in Poriya, Israel was designed as a multidisciplinary clinic to fight obesity in children in the area. The clinic currently collects data through a self-report lifestyle questionnaire (LSQ) and cardiopulmonary exercise testing (CPET) to create intervention programs and analyze connections between objective and subjective evaluations of lifestyle, physical activity (PA), and cardiorespiratory fitness (CRF). **Methods:** This study analyzed the clinic's current assessment tools and reviews of established physical activity questionnaires (PAQs) in order to recommend additional and/or alternate measurement tools to optimize patient evaluation and treatment. Data from 63 patients was used in this investigation. Results: Reviews of PAQs found moderate to high reliability and validity for the PAQ-C/PAQ-A. LSQ variables yielded different correlations to overall lifestyle classification: "screen hours ($r=0.32$), exercise limitations ($r=0.03$), NYHA functional classification ($r=0.05$), beverage choice ($r=0.05$), organized meals ($r=0.04$), and hours of extracurricular PA ($r=0.08$). **Conclusions:** To improve the validity and reliability of research data, the Health and Sports Clinic for Obese Children should use the PAQ-C and PAQ-A and its activity monitor of choice (accelerometer, pedometer, Caltrac, etc.) in addition to the previously used CPET and LSQ. Making adjustments to the current protocols to include both subjective and objective measurement tools will provide a more comprehensive evaluation of a child or adolescent's PA level, CRF, and lifestyle choices.

Poster# 17

Pediatric Cancer Temporal Trends and Persistent Survival Disadvantages in the United States by Race/Ethnicity and Sex: Surveillance, Epidemiology, and End Results

Leyana Casey

Major: Health and Exercise Science

Mentor: Jeffrey Katula, Health and Exercise Science

Cancer is the leading disease related death among children, this group consists of children between ages of 0 to 19 years old. Several studies have shown noticeable differentiating trends in the diagnosis and survival rates of white and black children. White children are diagnosed more than black children, but black children have lower survival rates compared to white children. The impacting risk factors include the Socio-Economic Status (SES) of the child and their parents, and the factors that affect their SES. The purpose of this project is to determine if the trends observed in racial and sex disparities among pediatric cancers have narrowed. The data from the Surveillance, Epidemiology, and End Results Program (SEER) was used and analyzed using chi-squared test, risk ratio, and the Mantel Haenszel Stratification Analysis. When the risk ratio tests were run, blacks were shown to be at a 30% higher risk of dying than their white counterparts and males were at an 18% higher risk in comparison to females. African-American children demonstrated survival disadvantages which persisted after controlling for tumor prognostic factors and social determinants of health such as environment, education, and median income.

Poster #18

Extraction Method Development for Urinalysis of Naloxone and Naltrexone on LC-MS/MS

Thomas Cecil

Major: Chemistry

Mentor: Christa Colyer, Chemistry

The goal of this research was to develop an efficient extraction method for drugs naloxone and naltrexone in patient urine samples, to enable their determination by liquid chromatography with tandem mass spectrometry (LC-MS/MS). This work was done at Aegis Sciences Corporation, a healthcare and forensic laboratory sciences company based in Nashville, TN, in partnership with Wake Forest University. Naloxone (which is known by its brand name Narcan) and naltrexone are mu-opioid receptor antagonists, which can counter the effects of opioid drugs by strongly binding to opioid receptors. Determining the levels of naloxone and naltrexone in patient samples is commonly requested as an add-on to standard forensic tests. Prior to this project, Aegis Sciences used a manual liquid-liquid extraction method for the preparation of patient urine samples for testing. This work focused on the development of an automated method. The method developed is known as a "dilute and shoot" extraction method, which can be automated with additional markers to help with the detection of naloxone. This work also found a more efficient replacement enzyme for hydrolysis of the glucuronide metabolites of the drug analytes. As a result of these improvements to the extraction and hydrolysis procedures, detection limits for naloxone and naltrexone of 10 ng/mL were established.

Poster #19

Identification and Characterization of Kinases in GMPR Regulation

Jialin Chen

Major: Biochemistry and Molecular Biology

Mentors: Mikhail Nikiforov and David Wolff, Cancer Biology,
Wake Forest School of Medicine

Melanoma skin cancer has become increasingly prevalent in the past 30 years. Melanoma is a cancer deriving from pigment-producing melanocytes. Localized melanoma has a 5-year survival rate of 98%. Once the melanoma tumors become invasive and metastasize, the survival rate drops to 20%. Invasive capability is necessary for melanoma cells to break through the basal membrane and spread to distant organs via circulatory system. Our laboratory has previously established that guanosine monophosphate reductase (GMPR) suppresses the melanoma invasion. The data has suggested that the loss of GMPR expression is a consequential event in melanoma progression and metastasis. However, the regulation of GMPR at post-translational level is still unknown. Thus, the overarching goal of our current study is to identify underlying mechanisms regulating GMPR protein in melanoma cells. We found that the phosphorylation of Tyrosine 267 is imperative for GMPR activity. Therefore, the identification of the kinases responsible for the phosphorylation of Tyrosine 267 will provide insights into the signaling pathways regulating the GMPR and the metastasis in melanoma. However, identifying and characterizing kinases regulating GMPR requires phospho-specific GMPR antibodies, and no such antibody is commercially available. Therefore, we purchased a custom-made pGMPR^{Y267} antibody. The goal of my project is to use cell-based and biochemical assays to confirm the specificity and utility of this antibody for pGMPR^{Y267}. This will allow for individual testing of kinases for their ability to regulate melanoma cell invasion via phosphorylation of GMPR.

Poster #20

Setting the Scene: An Exploration of Theatrical Space

Silin Chen

Major: Theatre

Mentor: J.K. Curry, Theatre and Dance

While theatre designers are trained to analyze a script and translate the world of the play into visual language, theatre space is often overlooked during the creative process. When I did my first realized scenic design last fall, I struggled to fight against the architectural features of the theatre to accommodate the scenic elements that I envisioned. That experience led me to my research over the summer, which focused on the emergence of a myriad forms of open stage theatres in the 20th century, the popular concept of environmental theatre, and the way designers respond to architectural space in contemporary productions. I visited a variety of theatres in Germany, Austria, the Czech Republic, and the U.K., such as Hellerau Festspielhaus, the archetype of modern theatre architecture, the Bauhaus school in Dessau where Walter Gropius designed a transverse “festive area”, and the Olivier Theatre at Britain’s National Theatre at which the open stage locates in the corner of the room. I also got a taste of site-specific performances at the 2019 Prague Quadrennial of Performance Design and Space which brought thousands of designs from all over the world. A close observation of those experimental architectures and productions along with the study of the modern movement gave me a new understanding of the relationship of actors and spectators, of performance and architecture. It encouraged me to approach theatrical space in a different way during my design process for the Mainstage production of *How I Learned to Drive*.

Coordinating Atmospheric Measurements with Multiple Unmanned Quadcopters

Ethan Cooley

Major: Engineering

Mentor: Kyle Luthy, Engineering

Our engineering team undertook a project involving the design and construction of autonomous quadcopters to collect environmental data during controlled wildfires. The goal was to create a scaleable network of drones that “swarm” over a specified region before, during, and after controlled burns. With this system of drones, environmental researchers can have a multi-purpose tool that can provide data to create, interpret, or validate models.

During our research, we looked at buying parts and compared our options by cost, performance, and reliability. The drone was designed with a focus on most efficient flight time, autopilot functionality, and ability to include multiple sensors and payloads. A GPS stand was 3D printed and the flight controller was connected to Ardupilot for autonomous flight. We faced multiple issues including a melted solder joint and inability to recognize radio input.

Although these were quickly resolved, they forced us to look into the possible safety threats. Mitigating the risk of drone use and preventing injuries was a priority for our team, and different case scenarios were laid out into a risk matrix. To combat the risk of drone use we programmed failsafes, applied blade guards, and looked at impact detection sensors. After understanding drone use risk, we calibrated and tuned the drones for autonomous flight. We implemented the telemetry sets for wireless communication and set flight modes on the transmitter. Our focus will now shift towards further development of autonomy algorithms for multi-drone coordination.

Poster #21

Education Law and Undocumented Students

Maria Cortez-Perez

Major: Sociology

Mentor: Michael Pisapia, Politics and International Affairs

My study approached constitutional and education law to produce a mock amicus brief in support of undocumented students in South Carolina. South Carolina has severe anti-immigrant laws in place which bar undocumented students from applying to higher education institutions.

My research consisted of presenting possible arguments that may not have been considered before in the mock amicus brief. I also researched the different supreme court judges in our district to strategize further as to whom and where to file a possible law suit in our circuit.

Poster #22

Parental behaviors and emotional development in children with ASD

Heather Cozzie

Major: Psychology

Mentor: Deborah Best, Psychology

Autism Spectrum Disorder (ASD) is an increasingly diagnosed psychological condition encompassing deficits in social communications and interactions and restricted, repetitive patterns of behavior (American Psychiatric Association, 2013). This study focused on the social deficit aspect of ASD, specifically on two criteria: "deficits in social-emotional reciprocity" and "deficits in developing, maintaining, and understanding relationships." Research shows that children with ASD show increased negative emotional reactivity, or heightened negative emotional responses to situations, and lowered ability to regulate emotions compared with typically developing (TD) children (Mazefsky & White, 2014). Previous research has shown emotional reminiscing and parental response to a child's emotional displays are related to emotional development in typically developing children. This ongoing study will use parent-report data on questionnaires about emotional reminiscing and parental response to children's negative emotion, the child's empathy, and the child's symptomology on ASD, social phobia, and other social delays obtained through a Qualtrics survey to assess relationships between these behaviors and a child with ASD's emotional development, as well as any differences when compared with parent-reports on the same measures for typically developing children. Results are hypothesized to find lower emotional reminiscing and less supportive parental responses in parents of children with ASD than parents of typically developing children, and an association with higher scores on symptom measures in both groups. The findings of this study could be beneficial as a potential therapy target for parents of children with ASD.

Poster #23

The Effect of an Exercise Training Program on Metabolic Flexibility in Older Adults with Prediabetes

Katharine Cunnane
Major: Biology

Mentor: Gary Miller, Health and Exercise Science

More than 30 million people in the United States suffer from diabetes. 90-95% of those with diabetes have Type 2 Diabetes (T2DM), a risk factor for heart disease, dyslipidemia, neuropathy, nephropathy, and retinopathy. Metabolic inflexibility, defined as the resistance of cells to switch from one fuel source to another, has been observed in persons with insulin resistance, T2DM, and obesity, providing a link between T2DM and its comorbidities. It is thought that a tissue's impaired capacity to switch from glucose oxidation to lipid oxidation when lipids become the primary substrate may result in ectopic fat distribution and contribute to insulin insensitivity. Previous studies have determined that exercise training can increase cells' ability to switch from the breakdown of sugars for fuel to the breakdown of fats for fuel, but it is unknown whether these effects vary according to age. In the current study, we aim to evaluate how moderate aerobic exercise training impacts exercise-induced lipid oxidation in an elderly, prediabetic population. Twenty participants will undergo baseline testing to determine the amount of fats they oxidize relative to carbohydrates when they exercise at half of their maximum intensity. All 20 participants will undergo a 6-week aerobic training program in which they walk for 1 hour for 3-5 days a week. Follow-up submaximal exercise tests will indicate if participants metabolize the same proportion of fats after exercise training. We hypothesize that the exercise training program will increase individuals' relative fat oxidation during exercise and, thus, improve their metabolic flexibility.

Poster #24

Functional comparison of two Tils homologs

Sarah DeHorn

Major: Chemistry

Mentor: Rebecca Alexander, Chemistry

Our lab is curious about the enzyme tRNA-isoleucine lysidine synthetase (TilS), which functions to overcome a decoding challenge at the ribosome. My research explores the effects of mutating four arginine residues within this enzyme's catalytic domain in two different bacterial systems: *Escherichia coli* and *Burkholderia cenocepacia*. Specifically, I am working to characterize the lysidinylation activity and binding of tRNA this enzyme can perform. The lysidinylation assay we perform utilizes TilS in the presence of radiolabeled lysine and wild-type tRNA to characterize the rate at which wild-type and mutant enzymes catalyze lysidine synthesis. The outcome of this assay showed that all of the mutant enzymes were inactive. Characterization of TilS's binding to tRNA was carried out through the use of an electrophoretic mobility shift assay (EMSA). This assay utilizes radiolabeled tRNA and differing concentrations of mutated and wild-type protein. These EMSA assays showed that the mutated proteins bind with comparable dissociation constants (K_d) to the wild-type enzyme.

The conclusion we drew from these characterizations is that the four arginine residues we selected in the catalytic domain are essential to the catalytic activity (but not tRNA binding function) of TilS.

Poster #25

The Healthcare and Culture of Hargeisa, Somaliland

Riyan Deria

Major: Psychology

Mentor: Steven Folmar, Anthropology

Somaliland is an autonomous, self-declared nation in the Horn of Africa, bordered by Somalia, Ethiopia, and Djibouti. Somaliland was virtually destroyed in the Somali Civil War and arose from the failed state of Somalia in 1991. It has been slowly rebuilt over the last twenty eight years; Somaliland now has a functioning democratic government, military, police force, functional currency, and educational system. However, Somaliland still suffers from an extremely underdeveloped healthcare system due to a lack of infrastructure from the civil war and previous colonization of the British. Somaliland is not internationally recognized as a sovereign state by any country or international organization, which prevents it from receiving outside aid or loans. As a direct result, most government-funded facilities are chronically underfunded, understaffed, and overcrowded with patients. Additionally, maternal mortality rates in Somaliland are among the highest in the world; Per every 100,000 live births, 732 women die (WHO, 2015). In comparison, 14 women die per 100,000 live births in the United States (WHO, 2015). The purpose of this research was to explore all modes of access to healthcare and become immersed in the Somali culture by conducting interviews with residents and visiting different types of healthcare facilities in the capital city of Hargeisa.

Poster #26

The Cult of Hebe: Exploring the Portraiture of Aristocratic Ladies during the Ancien Regime

Eliza Dermott

Major: Art History

Mentor: Morna O'Neill, Art

Portraits of women at court were complex and multivalent statements of social and political roles. As such, they were often the result of close collaboration between artist and sitter.

Feminine identity and artistic identity were often conflated in the articulation of social roles. The folds of a gown, the details on a piece of jewelry, the curve of a hand – such pictorial details were important markers of identity in the circumscribed world of the royal court. Given the emphasis on the details of representation the success of this project hinges on the close visual examination of actual works of art from the period, as well as knowledge of the display contexts in which they were first received, such as the rooms at the Louvre (home of Salons, the biennial exhibition of contemporary art organized by the Royal Academy) and the Palace of Versailles and its adjacent buildings. Given the association of women with the interior, reconstructing historical receptive context and interior environment provides the most opportunity for finding women negotiating their identities in time and space. Using works such as Nattier's *The Duchesse de Chaulnes Represented as Hebe* (1744) and *Portrait of Louise Henrietta de Bourbon Conte, Duchess of Orléans* (1732) from my travels around Paris, London, and Berlin, my research explores the intersection of mythology, court portraiture, and the construction of femininity, ultimately concluding that the story of feminine portraits is completely different across the landed (old) and new aristocrats, calling for new questions of iconography, form, and content.

Cultural Differences in Time Orientation in the US and Cuba

Anthony DeVincentis

Major: Psychology

Mentors: E. J. Masicampo, Psychology and Linda Howe, Spanish

This project focuses on cultural differences in the perception and organization of time between citizens of the United States and citizens of Cuba. These two nations, while they share centuries of history and a complex relationship, represent two distinct cultural entities, and their citizens exhibit markedly different time orientations. These differential orientations play a role in the nature of scheduling, time awareness, and multitasking efficacy in these two cultural spheres. The purpose of this project is, first, to test the hypothesis that there is a difference in time orientation between these two countries and analyze quantitative documentation of this difference, and, second, to qualitatively examine the possible reasons for this difference.

Theoretical models of time orientation have been developed by cross-cultural psychologists. Using the theoretical distinction between monochronic orientation (linear, traditionally "western" view of time) and polychronic orientation (cyclic, relationship-orientated, and traditionally "eastern" view of time), we constructed a polychronic-monochronic tendency scale, which documents a quantitative measurement of time orientation in Cuban participants and American participants. We found that country of origin was a statistically significant predictor of time orientation, such that Cuban participants displayed a significantly more polychronic time orientation than American participants. These results lend support to the hypothesis that there is a cultural difference in time orientation between the United States and Cuba. We then examined possible reasons for a cultural difference in this area, focusing on political structure, historical development, and aspects of daily life such as transportation, consumerism and services, and shared cultural narrative.

Poster #27

Mathematical Modeling of Sex Trafficking

Elizabeth Dicus

Major: Mathematics

Mentor: John Gemmer, Mathematics and Statistics

In this work we adapt a compartmental model developed by Davidoff by coupling the men and women's population through supply and demand. The Davidoff models the women and men's populations as a system of differential equations, in which the women's population flows between Susceptible, Prostitute, Rehabilitated, and Incarcerated compartments and the men's population flows between Potential Customers, Abstainers, Active Customers, and Incarcerated. However this model does not account for the interaction between the women and men in the sex industry. To ameliorate this problem, we developed a model that couples the women and men's systems, specifically accounting for supply and demand. Currently we are exploring bifurcations in this system, with respect to parameters such as incarceration rate and poverty. rehabilitation. Once this analysis has been completed, the next step is to apply the model using parameters drawn from real world data. We are especially interested in using data from countries with varying poverty levels, incarceration rates, cultural differences, and immigration control, such as the United States, India, Greece, the Netherlands, and the Philippines.

Poster #28

Can You Spot the Dots?: Innovative Technology for Analyzing Cave Art

Christian Estrada

Major: Anthropology

Mentor: Paul Thacker, Anthropology

In a small cave near Abrigo de Vibora in central Portugal, archeologists have identified possible painted surfaces dating back to prehistoric times. Thousands of years of weathering in combination with complex natural mineral staining of the limestone bedrock has made it difficult to resolve the painted images. Previous attempts to differentiate between natural mineral staining and painted surfaces included ultraviolet and infrared photography and complex software filter and digital processing techniques. My research explored a new and reliable method using color reflectance technology and carefully controlled light sources at the cave site. The Pantone Capsure RM200 device uses 25 LEDs to illuminate a sample surface with known wavelength of visible and UV light. A sensitive CCD sensor captures images, which are analyzed by an algorithm to assign a precise color designation. A range of natural surfaces were analyzed alongside the cliff as a control for the variety of mineral staining's. I also analyzed the possible paintings and pecked crosses, taking multiple measurements with each sample to ensure accuracy. After analyzing the data, the Munsell Digital technology appears to be a reliable tool for classifying the mineral differences between painted and natural surfaces. The controlled light source and enclosed sensors make color reflecting technology a promising alternative method for researching cave paintings.

Poster #29

How loss of sensory modality affects *Tigrosa georgicola* prey attack behavior

Lydia Faber

Major: Biology

Mentors: Erik Johnson, Biology and Glen Marrs, Biology

Predatory aggression is a complex process that involves integration of external stimuli and internal decision making regarding prey type and most effective attack strategy. *Tigrosa georgicola* (Family: Lycosidae), a native North Carolinian wolf spider represents an excellent model for observing predatory aggression. This experiment utilized *T. georgicola* spiders to demonstrate the use of sensory modalities associated in prey species detection. Preliminary investigations determined that *T. georgicola* flips other spiders and pounces on crickets during prey capture. These observations also led to the conclusion that flip behavior is influenced by spider prey size, as larger spiders were flipped more frequently. Based on this flip behavior occurrence, blind spiders possess the ability to discern between species of prey, but not prey size. Thus, it is clear that the spiders are using different senses for prey detection. If ground vibrational clues are removed, then resulting flip behaviors will demonstrate a lack of prey species differentiation.

Poster #30

Sequence Analysis of Rotavirus A VP4 and VP7 genes

Ning Fang

Major: Biology

Mentor: James Pease, Biology

The Rotavirus A genes VP4 and VP7 comprise the outer layer of the virion and have roles in cell intrusion, where VP4 binds to the cell surface receptor and VP7 neutralizes antigens.

We have constructed a database of Rotavirus sequence variation. Whole genome sequences and sample information (location and date of collection and host type, etc.), of all virus strains found on NCBI were downloaded, and errors in entries were corrected. Phylogenetic trees and sequence distance matrices for VP4 and VP7 genes demonstrated complex patterns of evolution at the protein and nucleotide levels.

Poster #31

Probabilistic Enhancements to Bayesian Networks for *Arabidopsis thaliana* Gene Interactions

John Farrell

Major: Computer Science

Mentors: David John, Computer Science and Jim Norris,
Mathematics and Statistics

The aim of this project is to develop a state of the art network model for molecular signaling. This NSF funded interdisciplinary project is a collaboration of researchers from Biology, Statistics, Computer Science, and Mathematics, and is associated with the WFU Center for Molecular Signaling.

This URECA sponsored summer research improved the current gene interaction modeling algorithm (BCHC algorithm). The BCHC algorithm takes gene transcripts as input and outputs a network whose nodes are genes and whose edges are labeled with Bayesian posterior probabilities. Efforts focused on two objectives: implementing *time series adjustment* (TSA), and incorporating *non-uniform prior probabilities*. TSA was added to next state and cotemporal analysis paradigms in order to more accurately model *Arabidopsis thaliana* gene interactions. Interaction models generated with the addition of TSA displayed consistent posterior probabilities. Previously, forbidden edges were implemented exclusively with prior probabilities of 0. This summer, the BCHC algorithm was enhanced to include a range of prior probabilities. This addition allows for flexible gene interaction modeling, allowing the biologists to inform the BCHC algorithm on the probabilities of the relationships between specific gene pairs.

Many gene models were constructed on simulated and experimental data. From the Muday lab, experimental data included *Arabidopsis thaliana*'s gene transcript selections of 12, 26, and 37 genes. Currently, a larger dataset of 65 gene transcripts is being collected in the Muday lab. The algorithm developed this summer will model this larger set. Network models can be computed for other types of data.

Poster #32

Organic Semiconductors as Radiation Dosimeters for Medical Applications

David Filston
Major: Physics

Mentors: Oana Jurchescu, Physics and Andrew Zeidell, Physics

Organic semiconductors can be used to create novel electronic devices on flexible substrates. One of these, the transistor, acts as an electronic switch that can be manipulated by voltage. In this study, we used organic field effect transistors (OFETs) as radiation dosimeters for medical applications.

Radiation dosimeters measure radiation exposure to patients in healthcare and for machine calibration. In a clinical setting, it is critical to control the radiation dose a patient receives, this control enables doctors to deliver the precise dose needed, without overexposing the patient. OFETs are light-weight and conformal since they can be placed on thin-flexible substrates.

Thus, dosimeters based on OFETs offer the advantage of placing sensors directly onto the patient to determine the real dosage. Additionally, they are low cost due to the ease of processing they require.

To construct large area devices, a modified 3D printer with an air brush was used for large area spray deposition of uniform thin films. Devices were measured as a function of exposure dose, in incremental amounts of radiation from 10 cGy to 1000 cGy, using treatment facilities at Wake Forest Baptist Health and then compared to a control device that has not been exposed to radiation.

We found that the radiation from Megavoltage X-rays induced electronic traps in the OFETs, which resulted in a shift in the turn-on voltage. By characterizing the voltage shift following radiation exposure we provided a solution for radiation detection that is based on the evaluation of the cumulative dosage.

Poster #33

The Catalytic Potential of G9a/EHMT2

Grace Franzese

Major: Biochemistry and Molecular Biology

Mentor: Lindsay Comstock-Ferguson, Chemistry

The expression of eukaryotic DNA can be altered through modifications like methylation to associated histone protein structures, which is involved in the cellular memory of transcriptional status, and as such plays an important role in heredity. Histone lysine methylations have been shown to play an important role and to have a wide variety of specifically targeted methyltransferases, such as EHMT2 or G9A. This enzyme targets the methylation of lysine 9 of Histone 3 (H3K9), which plays a role in the chromatin recruitment of the chromodomain-containing heterochromatin spreading protein HP1, chromatin condensation, and gene silencing. The overall mechanism of this enzyme is believed to occur in three parts, involving long range electrostatics that attract the electronegative peptide-bonding groove of the enzyme to the electropositive histone tail, interaction of structural determinants necessary for specific interactions with the substrate peptide, and formation of a catalytically competent conformation is by closing on the substrate. However, despite this evident breadth of knowledge on G9a, there still exists a gap in the research on methyltransferases, which is an issue because histone lysine methyltransferases, or HKMTs, have great potential as drug targets, considering their dysregulation can result in the reprogramming of gene expression networks and has been associated with diverse diseases, including cancer. The ultimate goal of this research is to use mass spectrometry analysis in order to determine the ability of the methyltransferase G9a to transfer azide- and alkyne- functionalized N-mustard analogs of SAM, which are more conducive to further research.

Poster #34

Studying the Link Between Diabetes, Estrogen, and Cognitive Performance

Jessica Frost

Major: Biochemistry

Mentor: Christina Hugenschmidt, Gerontology/Neuroscience,
Wake Forest School of Medicine

Type 2 diabetes mellitus is a known risk factor for developing dementia. Additionally, there is also a known interaction between raised estrogen levels and diabetes. The primary aim of this study is to analyze the effects of raised estrogen levels on cognitive performance in cognitively-normal diabetic and non-diabetic women aged 65-80 years old. To test changes in cognitive performance, a functional MRI (fMRI) and cognitive tests will be performed before and after estrogen administration. During the months of June and July of 2019, the primary focus of this research fellowship was to research the link between estrogen, diabetes, and dementia and build an adaptation of the Face-Name Associative Memory Examination with E- Prime 2.0 to be used in the fMRI.

Poster #35

Experimental Recreation of Bronze Age Organic Dyes

James Furman

Major: Anthropology

Mentor: Paul Thacker, Anthropology

The Bronze Age site of Castro de São Martinho, Portugal contained a large charcoal and burned sediment feature, larger than a traditional hearth, and several spindle whorls, which were used for spinning yarn in cloth making. During flotation of the excavated sediment, seeds and fragments of various non-edible, flowering plants were recovered. A possible explanation for this macrobotanical assemblage is that the prehistoric people at this site were boiling plants in order to produce flax dyes. In order to test this hypothesis, we systematically collected wildflowers and possible dye plants in the region and attempted to replicate the ancient dying process and determined the plants' effectiveness as organic dyes. My research involved the coordinated collection of 25 diverse plant samples which included documenting the geographic coordinates and altitude at which the plants were growing. At the field laboratory in Azinheira we dried and crushed each sample before boiling each individually along with a small amount of vinegar. Swatches of 100% cotton fabric were boiled along with the samples and allowed to cold soak for 24 hours. Once the cloth samples were removed from the dye mixture the colors produced were recorded using a Munsell digital reflectance spectrometer. My results demonstrate that several plant samples we processed were capable of producing strong organic dyes. This experimental research supports the hypothesis that fabric dying activities produced the archaeological feature at Castro de São Martinho.

Poster #36

Characterizing TiO₂ and organic polymer-based thin film nanodevices

Elinor Grage

Major: Undeclared

Mentor: Elham Ghadiri, Chemistry

The photocatalytic property of a UV-Vis-NIR light absorbing organic polymer were compared with that of a known photocatalytic inorganic materials (TiO₂) in a series of photocatalysis experiments designed to quantify photocatalytic ability. In specific, the behavior of the composite of the organic polymer with TiO₂ was compared to TiO₂'s performance alone in degrading the dye methylene blue's spectrum both in solution within it (free floating), and in the form of a thin film nanodevice at the bottom of the solution. Through these comparisons we could determine if the organic polymer could work on its own in photocatalysis of a dye, and further, if the inorganic TiO₂ and the organic polymer work together.

Thin film preparation methods of our catalysts were investigated to make the data as accurate, and reproducible as possible. Different methods of drop-casting and spin-coating were tried, determining the respective quality of the film visually, by weighing the thin films after all depositions, and by measuring its UV-Vis absorption. For the TiO₂ thin films alone, a standard volume of paste and area for the film were used to doctor-blade thin films similar in quantity of TiO₂, over a similar area of a similar thickness. Afterwards we studied the effect of plasma cleaning on the quality of organic polymer-only films and we discovered that this extra step on the glass substrate allowed for the production of a significantly more even and reproducible thin film, granting an avenue for further study and experimentation not before thought of as possible.

Poster #37

Politics in Formation: Forming an Account of Approach and Response in a Pluralistic Democracy

Coleman Greene

Major: Politics and International Affairs

Mentor: Michael Lamb, Interdisciplinary Humanities & Program for Leadership and Character

How should religious citizens respond to political outcomes in a pluralistic democracy? Like all citizens, religious citizens face political wins and losses at the ballot box, in presidential campaigns, and in policy decisions. Yet the oversimplified conversation in political theory suggests that the role of religion in politics is only to translate a citizen's religious beliefs into political rationale. What if religion also had something to say about how a person responded toward these political successes and hardships? In my paper, I argue that religion forms how a citizen approaches and responds to politics. Citizens do more than just rationally transfer their religious beliefs to political reasoning. Rather, their political engagement is formed by relevant practices, virtues, communities, and narratives. In my research, I examine how the false debate from political liberalism misinforms our understanding about religion in politics and contributes to an emaciated public square. Further, I propose "the formation view" as an alternative framework for understanding the religious citizen and show how a religious citizen might be formed to engage in politics. Finally, I suggest employing this formation view to establish a more rigorous posture of response in a pluralistic democracy. These observations are a result of 10 weeks researching and working in Washington, DC.

Examining AKH release and survival in starvation conditions of *Drosophila Melanogaster* when blocking gustatory receptors

Matthew Gronberg

Major: Biochemistry and Molecular Biology

Mentor: Erik Johnson, Biology

My URECA project examined the Gustatory receptors as well as some orphan genes in *Drosophila melanogaster* through behavioral assays and the beginnings of data analysis. Husbandry of the flies was performed once every two weeks to maintain many of the stocks of flies the Johnson lab was using. The flies were propagated into larger populations and each day they were sexed into males and female virgin flies. Our goal was to examine the effect of AKH release during starvation conditions when certain Gustatory receptors were blocked using the Gal-4 – UAS system. A baseline was run with 3 replicates on each strain to determine their survival curve. Following this, the crosses of each fly line was performed, and the same behavioral assay was performed to determine the effect the block of the various gustatory receptors would have on AKH release and overall survival curve. Due to complications with many crosses resulting in white eyed or curly winged flies, the data had to be discarded as this indicated our desired cross hadn't been achieved. Propagation of the crosses was continued and during this phase other projects were explored as well. A guide to all of the lab protocols including making fly food, building the starvation assay, husbandry, and sexing tips was written for future undergraduates. A video tutorial on how to build a CAFE assay that measures feeding habits was created which as well will be a focus of semesters to come.

Poster #38

Sensory Processes Involved in the Predatory Behavior of *Tigrosa georgicola* Wolf Spiders

Du Gu

Major: Biology

Mentors: Glen Marrs, Biology and Erik Johnson, Biology

There is limited reference about the specific sensory processes that are involved in the predatory behavior of wolf spiders. Initial study using *Tigrosa georgicola* and creation of a brain RNA library in our lab has uncovered that taste and olfaction receptors are seemingly absent. The reasons are that first of all, Wolf Spiders are external digesters, which means that digestive juices are ejected onto food outside their bodies, so taste is unnecessary as it won't involve the case that they swallow something bitter and need to spit it out.

Secondly, Wolf Spiders are known to utilize vibration for hunting [Sitvarin: 2015], similar to web building spiders. Thus, olfaction is perhaps not a necessary modality for wolf spiders either. Additionally, from previous research in the lab, we have tested blind Wolf spiders and found that they can still distinguish between prey crickets and spiders and performed correspondingly distinct predatory behaviors. Therefore, considering all of these different types of sensory processes, we believe that wolf spiders rely heavily on specialized leg receptors for predatory and other relevant environmental stimuli. Vibration sensors on spider legs are one focus, but we also have uncovered an array of TRP channels, a group of ion channel receptors that can be activated by certain chemicals so as to cause a wide range of sensations, by analyzing brain RNA libraries of *Tigrosa georgicola*.

Poster #39

Evaluating changes in coupled carbon, energy and water budgets during the 2012 flash drought event in Kansas using a land-surface hydrology model with predictive phenology

Noah Handwerk
Major: Engineering

Mentor: Lauren Lowman, Engineering

Flash droughts are caused by an excess of sunlight, lack of heavy rainfall, high temperatures, and strong winds during a growing season which leads to the rapid drying-up of soil. We investigate the role vegetation plays in the rapidly drying conditions. We use a 1-D column version of the Duke Coupled Hydrology Model with Vegetation (DCHM-V) to model vegetation water use and photosynthetic activity during the 2012 flash drought event for an AmeriFlux (AMF) site in Lawrence, Kansas. The goal is to evaluate whether vegetation (1) dampens the effects of a flash drought by storing water or increases the issue by taking all the moisture out of the soil, or (2) amplifies the drying out of soils by using all available water to undergo photosynthesis. Data from the MODERate Resolution Imaging Spectroradiometer (MODIS), reanalysis from the North American Land Data Assimilation System (NLDAS), and ground observations from an AmeriFlux eddy-covariance tower from 2010 to 2017 are used as meteorological forcing for the DCHM-V. Initial results demonstrate that the DCHM-V estimated gross primary productivity (GPP) and soil moisture for unstressed and flash drought events match well with the AMF tower and MODIS GPP estimates. Next steps for this work are to simulate canopy structural development during the flash drought event using the DCHM with predictive phenology (DCHM-PV) to understand plant water-use strategies under flash drought conditions. Results from this work have implications for understanding plant resiliency to drought that can inform cropping strategies to minimize financial losses in the United States.

Poster #40

Pattern and stripe formation in Zebrafish

Addie Harrison

Major: Applied Mathematics

Mentors: Bjorn Sandstede, Applied Mathematics (Project Advisor) and John Gemmer, Mathematics and Statistics (Major Advisor)

Zebrafish (*Danio rerio*) are a freshwater fish that are characterized by their black stripe and yellow interstripe pattern, against their counterpart Danios who display an array of different patterns. Zebrafish are a common species to study in biology due to their fully sequenced genome, mutant availability, and transparent embryo development. Zebrafish also make an interesting computational biology study subject because of their pigmented skin patterns. Their skin patterns develop from self-organizing cells which involves different mechanisms and variables that can be modeled from a mathematical perspective. Many of the mechanisms involved are still not well understood. However, continuing progress on empirical research has helped to provide more accuracy in developing the skin pattern mechanisms on zebrafish. Past research on the zebrafish, focused on developing a working five cell model for the fish body and a two cell model for the fin. Our team (Berke Türkay, Gisela Hoxha, Madison Russell, and Gil Parnon) focused on implementing and modifying the five cell model on the tail fin and anal fin.

Analyzing the model can help us understand the development of the zebrafish's pigmented pattern, which could have significant impact on future work in developmental biology, cancer, and genetic diseases.

Poster #41

Government Aid and Economic Growth in Tibet

Haosen He

Major: Mathematical Economics

Mentors: Jane Ryngaert, Economics and Yaohua Shi, East Asian Languages and Cultures

Since the mid-1990s, the Chinese government has undertaken a series of poverty-relief programs in Tibet, one of its most impoverished administrative regions. In 2017, the Tibet Autonomous Region (TAR) received a total of 197.56 billion yuan (approximately 29.88 billion USD) of economic aid, making it one of the most subsidized areas in the world.

This project investigates the efficiency of government aid in the TAR. The primary research question: Has the economic aid in Tibet, including infrastructure construction and agricultural subsidy, improved Tibetan people's standard of living? To answer this question, I conducted a 24-day field study in two major Tibetan cities, Lhasa and Nyingchi, and four rural areas: Linzhub, Damxung, Maizhougunggar, and Mainling.

My field observation shows that the impact of government aid in Tibet varies across regions. In the high-altitude pastoral areas, government aid is merely fiscal profligacy and creates a massive amount of idle and dilapidated infrastructure. In comparison, agricultural areas with lower elevation seem to benefit from government subsidies. Based on the findings of my field trip, I set up a regression model and performed an econometric analysis. My model suggests that government aid does not have a significant impact on Tibet's economic growth, and agricultural areas tend to have a higher rate of economic growth compared to pastoral areas, which confirms the findings of my field study.

Poster #42

K-12 Faculty and Administrator Perspectives on International Students' Strengths, Challenges, and Needs

Yueying He

Major: Psychology

Mentor: Nelson Brunsting, International Studies

In order to understand educators' perspectives on international students at private high schools in the United States, we conducted a focus group discussion with 11 teachers and administrators. We sought to understand international students' adjustment strengths, challenges, and needs. Although there is a substantial body of research on international students' adjustment at colleges and universities, the current literature on faculty's perception of high school international student adjustment topic is non-existent. From a grounded theory perspective, we used Charmaz's (2006) qualitative coding approach to answer our research questions. Emergent themes from the discussion include participants' perceived differences in international students' adjustment and engagement level based on students' region. Perceived strengths included academic success, while perceived challenges included social involvement, English use, and interactions with host families. Based on our findings, we provide recommendations for faculty, families, and students.

Poster #14

How do earthworms taste? A study of appetitive chemoreception.

Sydni Hill (co-presenting with Haley Buggy)

Major: Biology

Mentors: Cecil "Jake" Saunders, Biology and Wayne Silver, Biology

Soil conditions are key to the health and survival of our planet and its inhabitants. An essential, but often overlooked, player in soil conditions worldwide are earthworms. In this subterranean environment, earthworms rely on their chemical senses to make decisions about how they will interact with the world around them. However, little is known about what chemicals attract earthworms. In this project, the European nightcrawler (*Eisenia hortensis*) is used as a model organism to investigate appetitive and aversive stimuli. Researchers in this lab previously developed an assay for testing aversive stimuli. For example, we know that earthworms are aversive to NaCl and AITC. Our work has largely been focused on developing an assay for presumably appetitive compounds like glutamate. Previous research has indicated that earthworms feed on microorganisms in the soil. Therefore, we were interested in investigating bacteria as a potentially appetitive stimuli. In this experiment, we culture bacteria from the crop and gizzard of *E. hortensis*. Cultures of this (presumably consumed) bacteria were then used in our appetitive assay to test if it was an earthworm attractant. Our work thus far has yielded an assay for identifying appetitive compounds and has begun to illuminate the influence of bacteria on earthworm behavior. Identifying compounds that are appetitive to earthworms could be used to attract earthworms to rehabilitate polluted soil.

Poster #43

The Mechanism of Centrosome Amplification in Cells Treated with Hydrogen Peroxide

Lindsey Hoots
Major: Biology

Mentor: Heather Brown-Harding, Biology

One of the most common changes in cancerous cells is centrosome amplification, which occurs when more than two centrosomes are produced in a cell. This amplification leads to unequal chromosome distribution during mitosis. It is known that cells, while aging or under stress, produce hydrogen peroxide leading to extra centrosomes, so we aimed to determine how hydrogen peroxide contributes to centrosome amplification. To study this, cells were treated for 24 hours with the following chemicals in complement cell culture media and hydrogen peroxide: YC1 (100 μ M), LY 2904002 (50 μ M), Thymidine (2 mM), Monostrol (100 μ M), Quercetin (10 μ M). Each of these chemicals halted cells in differing stages of the cell cycle, and the cells were imaged to determine the effect on centrosome replication. The cells were found to be using the same centrosome replication procedure that occurs in unstressed cells but at a higher rate. Interestingly, we found that LY 2904002, which stops the cell in G1, demonstrated less centrosome amplification in the presence of hydrogen peroxide than control cells or LY 2904002 only cells. In conclusion, centrosome amplification due to hydrogen peroxide uses the same duplication pathway used by unstressed cells. However, the exact amplification signal that alters the mechanism rate is yet to be determined. Further experimentation will need to be completed to fully understand the mechanism and alterations that lead to centrosome amplification.

Poster #44

Rapid Triage of Radiation Damage Using Cell Electrophysiology

Juliana Hopper

Major: Engineering

Mentors: Erin Henslee, Engineering and Ravi Singh, Cancer Biology, Wake Forest School of Medicine

Radiation exposure, occurring from accidents or acts of war, can cause serious immediate and latent health implications. There is a critical shortage of methods capable of determining the extent of accidental exposures and thus early triage is necessary. Dielectrophoresis is an assay capable of characterizing cells based on their electrophysiological response and has been applied as a rapid analysis tool in various cell processes. To determine DEP's effectiveness as a rapid response triage method in radiation exposure, we assessed its ability to characterize radiation damage in a white blood cell model of Jurkat cells. The effects of radiation on Jurkat cells with regard to DNA damage, growth, and apoptosis are well characterized; the application of a DEP-based method has yet to be applied in characterizing radiation damage. In this project, the threshold dose of exposure timing and doses measurable by the system were investigated. Through dose experiments, it was determined that 4 Gy was the adequate dose to achieve at least 50% cell death. From there, DEP experiments were carried out at various time intervals after treatment, with significant changes in electrophysiological properties occurring between 6h and 24h. Namely, cytoplasmic conductivity consistently showed a significant decrease between 6-24h after irradiation. This is a significant finding, reinforcing DEP's utility in rapid radiation damage detection within 24 hours of exposure. Future work includes measuring DNA damage, apoptosis, and cell membrane integrity as well as determining the DEP experimental parameters necessary for a field kit capable of functioning outside of the lab environment.

Poster #45

Loss of Histone Methyltransferase CLRC Subunits Affects the Stability of Lysine Demethylase Lsd1 and Lsd2 in *S. pombe*

Tien-Chi (Jason) Hou

Major: Biochemistry and Molecular Biology

Mentor: Ke Zhang, Biochemistry and Molecular Biology

Histone modifying enzymes play important roles in regulating gene expression. Clr4 is the only methyltransferase at the 9th lysine (K) on histone H3 (H3K9) of *Schizosaccharomyces pombe* (*S. pombe*), while lysine-specific histone demethylase 1 and 2 (Lsd1/Lsd2) removes the methyl marks at this position. Clr4 forms the protein complex, Clr4-containing complex (ClrC), with the other four subunits including Raf1, Raf2, Rik1, and Cul4. In particular, Cul4 subunit is an E3 ubiquitin ligase although its ClrC-related substrate is not known. A previous study in Zhang lab found that loss of Clr4 is synthetically lethal with *lsd2* mutants, suggesting their function connections. To investigate the functional relationships between ClrC and Lsd1/2, I created strains by deletion or mutation on each subunit of ClrC, then combined them with flag-tagged Lsd1 or Lsd2 proteins. Using Western Blot, I semi-quantified the protein levels of Lsd1 and Lsd2 in strains carrying the mutants of ClrC subunits. I found that the protein levels of Lsd1 and Lsd2 were enhanced when the ClrC subunits were deleted. *raf1* Δ and *raf2* Δ deletion increased Lsd1 at least 10-fold and 8-fold respectively; *raf1* Δ and *cul4-1* enhanced Lsd2 at least 10-fold and 6-fold respectively. Since a protein ubiquitination often affects its protein level, my results suggest that the ClrC may modulate Lsd1 and Lsd2 protein levels through covalent modifying these enzymes such as ubiquitination.

Poster #46

Four Walls and an Entrance Fee: A comparison between museum and street art

Suchi Jain

Major: Biochemistry and Molecular Biology

Mentor: LeighAnn Hallberg, Art

I spent my summer in the heart of downtown Asheville, interning at the Asheville Art Museum and immersing myself in the culture of art for which the city is so well-known. The museum is beloved in Asheville as a city landmark and as an institution that holds much collective value. Asheville itself is as magical as people make it out to be, with constant music and art swirling through the streets. In such a prime location for both studio art and murals, I sought to explore what exactly constitutes the difference between museum and street art. I ultimately learned that both museum and street art play profound roles in the art scene, despite their differences in medium, context, control, and permanence, and my experience working in the Asheville Art Museum gave me an interesting means of exploring how these differences manifest.

Poster #47

A Tale of Two Cities - Historical Reconstructions and the Politics of Identities in Gdansk and Kaliningrad

Andy Jiang

Major: Politics and International Affairs and Russian

Mentors: Wei-chin Lee, Politics and International Affairs and Billy Hamilton, Russian

Throughout human history, the ownership of a piece of territory shifts from one regime to another. Despite the means of territorial transfer, whether it is the spoil of a war, the result of a revolution, or the result of a referendum, it is paramount for the new ruling regime to legitimize its claim to the land by deconstructing the image of the former government, and eventually constructing a new societal identity. On the coast of the Baltic Sea, two formerly German-controlled cities, Gdansk and Kaliningrad, experienced a series of relatively brief regime changes that were nearly identical in chronology. Gdansk/Danzig, the provincial capital of West Prussia, and Kaliningrad/Konigsberg, the provincial capital of East Prussia, both shared similar history until the end of World War II when the Soviet Union annexed Kaliningrad and placed Gdansk under the control of Poland SSR. There have been constant conflicts between the reconstruction of German culture and the preservation of the Soviet past in heritage production programs in Kaliningrad. However, in Gdansk, the identity reconstruction process was more spontaneous and autonomous.

To understand the extent and means that the new governments in Gdansk and Kaliningrad used to deconstruct the old societal identities and reconstruct new heritage, I traveled to the two cities to observe and interact with the locals. By inspecting architecture design, cultural displays, and public-school curriculum, I had a better understanding of the means, degrees, and the impacts of government actions on locals' social identities.

Poster #48

Differences in Mood Improvement after Support-Seeking Experience Among People with Different Levels of Pathological Attachment Styles

Yanni Jiang

Major: Psychology

Mentor: Lara Kammrath, Psychology

Though a common strategy adopted by many individuals to obtain comforts and eliminate anxieties, support seeking attempts cannot always result in satisfactory results. People with varied personal experiences and expectations toward interpersonal relationships also perceive supportive information differently. Many studies in the field have integrated attachment theory into the study of support seeking processes and results. The purpose of the current study is to build on the existing research by directly investigating the mentality of support seekers under the framework of pathological attachment styles. It is hypothesized that people with higher compulsive self-reliant attachment do not perceive significant mood improvement after support-seeking experience; while the higher people score on compulsive care-seeking attachment, the larger mood improvement they can perceive after support seeking. The type of supportive information (informational, emotional, tangible) will also be adopted in the study as a moderator to further investigate people's supporting experience. Approximately 120 participants will be recruited from the pool of students enrolled in introductory psychology class at Wake Forest University; the study will be consisted of two phases. The first phase involves a take-in session in which participants are guided to finish a questionnaire online. The second phase is an 18-day longitudinal daily support diary study. Researchers will send out the link to the daily diary survey via email every day and participants are required to complete the survey in a designated time period. Four aspects of information will be covered to record participants' support seeking experiences.

Poster #49

Creating a library of adenovirus E4orf6 protein variants for the development of AAV cells lines and therapeutic use in gene therapy

Nicole Johnsen

Major: Biochemistry and Molecular Biology

Mentor: David Ornelles, Microbiology and Immunology,
Wake Forest School of Medicine

One of the major challenges in the development of AAV cells lines for therapeutic use in gene therapy, is the generation of recombinant AAV vectors. The current method is costly, and difficult to reproduce for large scale therapeutic purposes due to the inefficiency of the three- plasmid transfection necessary for rAAV production. Furthermore, the E4 region in one of the three plasmids necessary for transfection (the pHelper plasmid) produces the E4orf6 protein, cytotoxic to cells in its wildtype state. My fellowship focused on creating a library of E4orf6 protein variants that are no longer cytotoxic to cells and yet still retain their ability to produce rAAV. The entire E4 region in the pHelper plasmid (including E4orf6) was deleted using inverse PCR. Next, the E4orf6 region was cloned into a separate plasmid so that the expression of E4orf6 alone may be quantified. A four plasmid transfection was then verified to be successful, confirming that introducing the E4orf6 region in its own plasmid was possible. The E4orf6 protein variants were next created by making single amino acid changes to the alpha-helix of the E4orf6 protein. Primers for inverse PCR were designed that had tails with the mutagenic changes. The PCR reactions then were subject to a KLD enzyme mix, and sequentially transformed into bacteria. 42 out of the 60 possible variants produced colonies. Later experiments allowed for the production of the remaining 18 variants. The DNA of these variants have been amplified, and future experiments are now aimed at quantifying their toxicity.

Poster #50

Perceptions of blood and health through the lens of caste in Kathmandu, Nepal

Timeri Jordan

Major: Anthropology

Mentor: Steve Folmar, Anthropology

Hierarchies are systems of stratification that structure our world, collectively and individually, in a network of power, culture, and history. These systems both maintain the structure and stability of a society and provide people with meaning and an understanding of the world in which they carry out daily practices. Nepal is a nation with a rich history of culture and the hierarchy that both structures and is structured by that changing culture. This study, conducted in areas of the Kathmandu Valley, Nepal, sought to examine the perceptions of blood and health in the scope of the caste hierarchy. The significant finding of this study, based on 26 interviews of people from a range of castes and backgrounds, was an ongoing cultural change illustrated through the perceived generational difference in beliefs about blood, health, and caste. This project also aims to express the holistic experience of the interviewees in order to obtain better insight into their ideas of how blood and health relate to their beliefs and experiences of caste identity; this holistic experience is explored through definitions of health, how religion is experienced and practiced, major health issues today, treatment methods, and discussions about health within communities. Holistic approaches lead to a broader understanding of the experience of individuals in the hierarchical and cultural systems of their worlds maintained by those in power.

Analysis of the gut tissue of rhesus macaques using immunofluorescent labeling with application to the study of malaria infection

Courtney Kaplan

Major: Biology

Mentor: Regina Cordy, Biology

This project aims to observe changes to the microbiome and gut tissue itself of an organism infected with malaria. Immunofluorescence labeling is used to visualize the different components of the formalin-fixed and paraffin-embedded gastrointestinal tissue of control rhesus macaques monkeys not infected with the *Plasmodium knowlesi* parasite. To label tight junctions in order to visualize the epithelial barrier which is of interest in regards to the effects of malaria, the Claudin-5 primary antibody was used in conjunction with a conjugated fluorescent secondary antibody that allows for confocal imaging of the tissue after labeling. Through testing of various concentrations of each antibody and Hoechst nuclear stain, a successful protocol was developed for the co-labeling of the tight junctions and tissue. A similar method was employed with the goal of labeling bacteria in order to understand the changes to the microbiome as a result of *Plasmodium knowlesi* infection using the primary antibody LPS and a conjugated secondary protein distinct from that used in Claudin-5 labeling. Autofluorescence of the labeled tissue during confocal microscopy made visualization of the labeled bacteria difficult, but was successfully quenched which is vital for the success of future co-labeling visualization. Continuous optimization of these protocols could lead to the development of a method for co-labeling using different fluorescent labels for each area of interest in the same intestinal tissue which, when applied to malaria-infected rhesus macaques, could allow us to study how the epithelial barrier, immune response, and microbiota of the gut are affected by malarial infection.

Poster #51

Quantifying distortions of cell nuclei

Paul Kefer

Major: Computer Science

Mentors: Keith Bonin, Physics and Pierre-Alexandre Vidi,
Cancer Biology, Wake Forest School of Medicine

Six feet of DNA are packed in a cell nucleus, and DNA undergoes double-strand breaks (DSB's) under standard cancer treatments. Movement of these DSB broken ends can result in undesirable mutations when different DNA strands are rejoined by DNA repair proteins. We hypothesize that greater motions produce higher cancer rates. To measure such motions, we developed a method to illuminate and track small 'bundles' of DNA in living cells. We create a grid of microscopic spots that 'dance' in movies taken at the microscope. Initial analysis of these movies revealed an unexpected cohesion between adjacent DNA spots.

Here, we present a new MATLAB toolbox to analyze DNA motions. First, we created a program that finds the cell nucleus containing the illuminated DNA spots. Second, we developed an algorithm to track spot positions relative to the border and the center of the nucleus. We find that DNA moves more at the nuclear periphery, which predicts more frequent translocations there. Third, we created a method to amplify and highlight DNA motions for visual assessments. This method revealed significant elastic distortions of whole cell nuclei. Fourth, we formulated metrics to compute the extent of nuclear distortion in individual cells. The metrics generally agree with visual inspection of distortion in the movies and have much lower values in fixed compared to live cells, as expected. Initial analysis found no correlation between the distortion values and cohesion of neighboring DNA spots, suggesting that the large-scale cohesion of DNA uncovered initially does not merely reflect distortions.

Poster #52

Analyzing immune cell populations of young healthy and normal cognitive aging subjects using machine learning

Chaeun (Jiah) Lee

Major: Biochemistry and Molecular Biology

Mentor: Jason Grayson, Immunology, Wake Forest School of Medicine

Alzheimer's disease (AD) is a neurodegenerative disease that results in memory and cognitive decline. Chronic inflammation and the accumulation of β -amyloid (A β) plaques are thought to contribute to the progression of AD. Currently, in order to stage AD, expensive imaging techniques and several cognitive function tests are required. However, with high dimensional flow cytometry of protein markers, in theory, AD can be more accurately staged with peripheral blood mononuclear cells (PBMCs) and cerebral spinal fluid (CSF). Healthy control (HC) immune cell proliferation and mitochondrial potential were analyzed as a preliminary step to analyzing AD immune cell populations. Young HC and normal cognitive aging (NC) subjects' immune cell populations were also compared. We hypothesized that stimulated T cells would result in increased proliferation and mitochondrial potential of T cell subtypes and that the number and/or quality of cells of older NC subjects will differ from those of younger HC individuals. An 18-antibody panel was used to compare the immune cell populations by flow cytometry. Unsupervised learning algorithms, t stochastic neighbor embedding (tSNE) and self-organizing map (SOM), were applied to the flow cytometry data using the R programming language. We were able to validate the 18-antibody panel and test the reproducibility of the panel on multiple HC samples. Through unsupervised learning algorithms, we were also able to identify differences in cell types between NC and HC subjects. These findings can be applied to AD samples to identify a comprehensive immune profile that can be used to stage the progression of the disease.

Poster #53

Coping in Caregivers of Pediatric Cancer Patients

Calissa Leslie-Miller

Major: Psychology

Mentor: Christian Waugh, Psychology

Engagement coping strategies have been historically viewed as more beneficial than disengagement coping strategies when it comes to dealing with chronic stress. However, we wanted to explore the use of positive distraction as an adaptive coping strategy for chronic stressors. In order to understand whether or not positive distraction would predict positive outcomes, we developed a scale to measure positive and neutral distraction as a result of chronic life stressors. Then, we created a correlation between the use of these distraction techniques and their outcomes. It was shown that both positive and neutral distraction were positively correlated with avoidance, as expected from distraction since it is a disengagement strategy. However, positive distraction was uniquely related to a variety of positive outcomes, including increased well-being and decreased depressive symptoms. This relationship confirms that positive distraction is a positive emotional coping strategy, despite being a disengagement stressor. These results suggest that when controlling for avoidance, positive distraction can be an adaptive coping strategy for chronic stressors, and therefore should be included in future studies and intervention.

Poster #54

Mapping Chromatin Motions in Live Cells through Structured Illumination of Photoactivatable Histone Probes

Benton Lietz

Major: Biology

Mentor: Pierre Vidi, Cancer Biology, Wake Forest School of Medicine

Chromatin is the complex of DNA and proteins that keeps the genome compact in eukaryotes. Dynamic chromatin motions are thought to be directly related to the biogenesis of genomic translocations which may lead to certain cancers. Current methods of measuring chromatin motions only take a few measurements per cell. This summer project characterized a novel approach based on structured illumination for simultaneous measurement of chromatin reporters. The experimental system is based on osteosarcoma cells that express photoactivatable red fluorescent protein bound to histone 2B (PAmCherry-H2B).

Measurements are obtained by shining an array of laser beams at the cell nucleus, which photoactivates specific points containing fluorescently tagged histones. These points can be tracked to determine the speed of diffusion of the chromatin. The new PAmCherry-H2B cell model was selected over various clones for high expression levels of the red photoactivatable histone marker. This clone produces a high signal intensity after photoactivation that can be easily distinguished from the background. Time-lapse video measurements obtained from the PAmCherry-H2B cell line enabled us to analyze chromatin mobility. In preliminary experiments, a green epigenetic sensor was expressed in the PAmCherry-H2B cells to detect a specific type of histone modification that causes chromatin to become more compact (tri-methylation of histone 3 lysine 9; H3K9me3). Results combining mobility measurements and this sensor indicate decreased chromatin motions in compact regions. In the future this method will serve to better understand what regulates chromatin motions, particularly when cells are exposed to DNA damaging agents causing genomic translocations.

Poster #55

Data Privacy in the Digital World

Tianen Liu

Major: Mathematical Statistics

Mentor: Nicole Dalzell, Mathematics and Statistics

In the data-driven era, we as data providers want our sensitive information to be kept private and secure. However, companies and government need to use data sets that contain sensitive information to ensure accurate analysis. With a trade-off between accuracy of data set and our privacy, differential privacy sets a privacy level for a public data set that benefits both data users and data providers. A differential privacy technique modifies a data set and ensures its usability for companies who analyze it without having to directly access the sensitive information in the original raw data. At the same time, data providers do not have to worry about data breach because, based on the differential privacy, it is unknown if a piece of sensitive information is the actual raw data or not.

In this presentation, we provide an introduction to differential privacy, including its definition, uses, and common methods. These include Laplacian noise, randomized response, and Bernoulli posterior predictives. While these methods give differentially private responses to queries asking for statistics of certain columns in a data set, we also explore other methods that generate synthetic data sets. We then conclude with an application of these techniques to create a synthetic data set on the 2017-2018 Open Sourcing Mental Illness data set.

Poster #56

Generalizing the Straightening Formula for Schur Functions

Xiaotian Liu

Major: Mathematics

Mentor: Edward Allen, Mathematics and Statistics

The Schur functions $\{s_\lambda\}_{\lambda \vdash r}$, where λ is a partition, form a basis for the ring of symmetric polynomials Λ_n of degree r . It is defined as the quotient of Vandermonde determinant $|V_n|$ and the extended Vandermonde determinant $|V_n^\lambda|$. When the Schur functions is indexed by a composition $\alpha = (\alpha_1, \alpha_2, \dots, \alpha_n)$, where $\alpha_i < \alpha_{i+1}$ for some i , we apply the Straightening algorithm to write s_α as a linear combination of $\{s_\lambda\}_{\lambda \vdash r}$.

The purpose of this paper is to generalize the Straightening algorithm. Define

$$V_{n,f,\alpha} = \left(x_j^{n-i+1+\alpha_i} f_i^{(j)} \right)_{1 \leq i,j \leq n},$$

with $f = [f_1, f_2, \dots, f_n]$, where $f_i \in \Lambda_n$, $\alpha = (\alpha_1, \alpha_2, \dots, \alpha_n)$ is a composition of r and $f_i^{(j)} = f_i|_{x_j=0}$ is partially symmetric. We prove that

$$\xi_{n,f,\alpha} = \frac{|V_{n,f,\alpha}|}{|V_n|} \in \Lambda_n$$

and we give a combinatorial algorithm for expanding $\xi_{n,f,\alpha}$ in terms of the Schur functions $\{s_\lambda\}_{\lambda \vdash r}$ using the *Murnaghan-Nakayama* Rule. This expansion uses the operator $D_j^{(i)}$ that acts on a composition $\lambda = (\lambda_1, \lambda_2, \dots, \lambda_l)$ by increasing the i^{th} digit of λ by j .

Poster #57

Expansion Microscopy to Visualize Double Stranded DNA Breaks

Tucker Loy

Major: Biophysics

Mentors: Pierre-Alexandre Vidi, Cancer Biology, Wake Forest School of Medicine, and Heather Brown-Harding, Biology

Biomolecules and fluorescent labels in cells and tissue specimens can be packed densely and therefore with traditional light microscopy, the resolution of these images can be insufficient for accurate analysis. Expansion microscopy physically expands the sample 4 to 5 times of the original size to improve images using the same light microscopy. Here we used an expansion microscopy method (Protein Retention Expansion Microscopy) with cultured U2OS cancer cells in order to improve resolution of images of 53BP1, a DNA double-strand break marker. The method consisted of cell fixation followed by immunostaining with 53BP1 antibodies. Then a dense gel polymer was formed and anchored to the proteins in the cells. This polymer was expanded with water and the cells were imaged with a confocal microscope. The attempt resulted in a 1.5-2 times size expansion of the cells, with improved resolution of 53BP1 foci. In the future, expansion microscopy will be used on different types of cultured cells and tissues to improve quantification of DNA damage levels. We also plan on using expansion microscopy dataset to improve images from non-expanded samples via a machine learning approach.

Poster #58

Anxiety Difference among Chinese, Chinese American, and American Students in US College Measured by Word-Induced Startle Response

Yucheng Lu

Major: Psychology

Mentor: Terry Blumenthal, Psychology

Suicide rate in colleges are increasing, and this also applies to international students. Research shows that Chinese international students have significantly higher anxiety than Americans (Han et al., 2013). This is probably because Chinese are more concerned about academic achievement and social relations. Shao et al. (2013) showed Chinese tended to develop anxiety in English learning environment though they were proficient. Chinese also have higher social anxiety level because they aim to avoid weakness and thrive to show a better self-image in social relations, which increases stress (Xie and Leong, 2008).

However, in previous studies, participants reported anxiety using self-reported questionnaires, which is potentially inaccurate. This current study used eyeblink startle response, which is more intense if one is anxious, and people cannot consciously control it. Participants were presented with academic words and social words while listening to startle sounds. Other positive, neutral, and negative words were also presented to serve as control trials. Chinese, Chinese-American and American students, each 20 participants, were recruited from Wake Forest Psychology introductory class and were given one course credit.

They also completed the Asian American Family Conflict Scale to see if family affected anxiety level. My hypothesis is Chinese students will have the highest academic and social anxiety followed by Chinese-American and American students. The three groups will not differ in control trials. The result are hypothesized to show Chinese have higher family conflict reported because their parents' expectation exceeded their achievement. Overall the experiment provided insight in counseling students from different backgrounds.

Poster #59

Longest increasing subsequence and log concavity

Haoxin Luo

Major: Mathematics and Statistics

Mentor: Sarah Mason, Mathematics and Statistics

This poster presentation will cover topics on permutations, specifically, the length of the longest increasing subsequence generated from a permutation and whether this subsequence is log concave. I will start with introducing what is permutation, concepts about the longest subsequence, and explaining the related background knowledge, such as the definition of log concavity and what is an RSK correspondence. I will then provide the results of some former studies associated with this topic to give some insights into what is going on with this study now. Based on those previous studies, my research moved forward to focus on the special hook shape and multiple row shapes of a permutation. We tested the log concavity feature of those subsequences for n less and equal to 50 using the supercomputer and further proved our generalizations through the lattice path method. On top of our current results, we made some future conjectures where we have tested for n less or equal to 10 but haven't got the chance to prove yet. Although the core idea of my research is based on math concepts and computations purely, the results of this log concavity and longest increasing subsequence concepts can be applied to explain and understand heredity and gene mutations.

Poster #60

The role of transcription factor TCP15 in regulating ethylene-induced flavonol synthesis in *Arabidopsis thaliana*

Lois Luo

Major: Biochemistry

Mentor: Gloria Muday, Biology

Ethylene is an important hormone that regulates plant growth at multiple life stages, including seed germination, root development, and fruit ripening. The response to this hormone involves regulation of the activity of transcription factors to turn on networks of transcriptional changes. This study focused on the transcription factor, TCP15, that may regulate ethylene-induced flavonol biosynthesis. Flavonols are secondary metabolites in plants that function as antioxidants. Previous studies in the Muday lab discovered that the expression of TCP15 is down-regulated by ethylene. Other studies discovered that TCP15 inhibits synthesis of anthocyanin, which is also in the family of flavonoids. Based on these studies, our hypothesis states that in the wild type *Arabidopsis*, TCP 15 inhibits the synthesis of flavonols, but in the presence of ethylene, as the levels of the protein decrease, flavonol synthesis increases.

Therefore, we expect to see increase in flavonol intensity in the root of *tcp15* knock-out mutants and decreased flavonols in plants that overproduce TCP15. To test our hypothesis, roots of wild-type *tcp15* knock-out mutant *Arabidopsis* were stained with DPBA, which is a color stain that shows bright in the presence of flavonoids. The stained roots were imaged with confocal microscope. We expect to see higher fluorescent intensity in the roots of *tcp15* knock-out mutant *Arabidopsis*.

Poster #61

The Role of Herbalism and Prophetic Medicine in the Healthcare System of Morocco

Mohammad Malik

Major: Biochemistry and Molecular Biology

Mentors: Darlene May, Arabic and Steven Folmar,
Anthropology

Increasing in popularity and utility, herbalism and Prophetic Medicine are prevalent forms of alternative medicine in Morocco. With rising healthcare costs and inadequate access to modern healthcare, herbalism and Prophetic Medicine remain despite significant advances in modern medicine. Herbal shops can be found across any marketplace across Fez, Morocco. Upon entry, one can find an assortment of plant-based treatments to cure anything from a minor headache to a variety of gastrointestinal conditions. Due to its prominence in markets across Fez, herbalism can be considered a public display of alternative medicine. Prophetic Medicine, or the use of the Qur'an and *hadiths* to treat illnesses, on the other hand, is conducted more privately. Due to Islam's staunch presence in Morocco, it is no surprise that Prophetic Medicine is a common practice across the North African country. Through the use of ethnographic methods my results demonstrate how both herbalism and Prophetic Medicine are involved in a unique interplay within the overall healthcare system in Morocco. By understanding the healthcare systems of other cultures and nations, physicians in the U.S will be better equipped when handling a more continually diversifying America.

Determination of the DNA/DNMT1 Binding Coefficient using Fluorescence Spectroscopy

Mohammad Malik

Major: Biochemistry and Molecular Biology

Mentor: Lindsay Comstock-Ferguson, Chemistry

DNA methylation, a dynamic and robust post-transcriptional modification, has been known to play a pivotal role in chromatin structure and gene expression. Alterations in DNA methylation patterns have been implicated in many diseases including cancer. DNA methylation is mediated in part by the maintenance DNA methyltransferase 1 (DNMT1) and involves the transfer of a methyl group from S-adenosyl-L-methionine (SAM) to the 5 position of cytosine within a CpG dinucleotide recognition site. Previous studies to explore the utility of functionalized N-mustard SAM analogs with DNMT1 indicated that added functionalities on the adenosine base may impact their function through hindering binding within the DNMT1 active site. To quantitatively measure whether these analogs are able to bind with DNMT1, a new fluorescence quenching assay was explored. To ascertain the utility of this assay, preliminary experiments to obtain a DNA-DNMT1 binding coefficient were conducted and yielded a K_d of 162.9 nM. Although this value was comparable to what has been previously reported in literature, the low DNMT1 concentration required for the assay generated large variations in the individual data points. Although this approach was anticipated to provide the groundwork for directly measuring the binding of SAM analogs to DNMT1, variation in data questioned its future applicability and an alternate methodology must be explored.

Poster #62

Synthesis of Platinum(IV) Acridine Anticancer Prodrugs

Ikeer Mancera-Ortiz

Major: Biochemistry

Mentor: Ulrich Bierbach, Chemistry

Platinum(II)-acridines are a class of anticancer agents that effectively kill cancer cells at nanomolar concentrations, but also show unfavorable systemic toxicity when administered to test animals. The goal of this project was to convert the highly cytotoxic parent compound into a more tolerable prodrug. Platinum-based prodrugs typically comprise a Pt(IV) center and show an octahedral coordination geometry, which renders them chemically less reactive than the Pt(II) drugs. An example of this type of prodrug is *cis,trans,cis*-[PtCl₂(OAc)₂(NH₃) (cyclohexylamine)], known as satraplatin, whose two axial acetato (OAc) ligands confer a high degree of stability to the compound while in circulation. After entering cancer cells, a reduction reaction transforms the Pt(IV) back into the active Pt(II) form of the drug that then attaches to DNA to stall cancer cell replication. Thus, the significance of this work is to widen the therapeutic window of these anticancer agents. Oxidative addition reactions were performed with the Pt(II) prototype (**1**) to install Cl⁻ and OH⁻ as axial ligands (compounds **2** and **3**). The OH⁻ ligands were then converted into acetate ligands using acid anhydride to afford compound **4**. High-performance liquid chromatography combined with mass spectrometry (LC-MS) was used to monitor the reactions and to assess compound purity. ¹H NMR spectroscopy and X-ray crystallography were used to characterize the new complexes. Future experiments are planned to mimic the compounds' bio-reduction chemistry under physiologically relevant conditions. Compounds **2–4** will also be tested in cell proliferation assays to assess their activity in lung cancer cell lines.

Poster #63

Autonomous Wireless Sensor Networks

Danette Martinez

Major: Engineering

Mentor: Kyle Luthy, Engineering

Wireless Sensor Networks (WSNs) applied to environmental monitoring experience constantly changing conditions. It is therefore beneficial for such networks to be able to rapidly adapt with little outside intervention to be more robust to changes. This type of behavior is even more difficult in networks consisting of different types of nodes or nodes with different capabilities (for instance: different sensor types, different actuators, different power supplies, different communication systems). This would be ideal for power management in static WSNs for long term environmental monitoring or for coordinated efforts of heterogeneous mobile autonomous systems for search applications. The initial efforts of this project were to develop the base infrastructure of a network testbed. First, a thorough market analysis of existing WSN platforms was performed. Ultimately, the Moteino was chosen due to its low power needs, adjustable communication system, and cost. Experimentation was performed to characterize the RF communication link between nodes with specific focus on received signal strength (RSS) and the built in automatic gain control (AGC). In some instances, the signal strength may be the only indication of relative positioning. Software models were also developed to explore coordination of nodes in a mobile network using the signal strength concept as a spring/mass system. This is promising for the development of de-centralized and scalable algorithms for coordination of heterogeneous mobile WSNs.

Poster #64

Therapy through Theatre: Connecting with the 'Other' in Yourself and Society

Katy Milian

Major: Psychology and Theatre

Mentor: Brook Davis, Theatre

In summer 2019, I researched psychodrama throughout England. I attended lectures, research plenaries, conferences, playback theatres, peer-support groups, workshops, arts therapy expos, training weekends, and a one-day-intensive with the London Center for Child Mental Health. In addition to psychology-based ventures, I watched eleven plays and journeyed to Stratford-upon-Avon, immersing myself in Shakespeare. These experiences were the lens through which I wrote an original play entitled: "Shatterproof." I used psychodrama techniques to look at both storytelling and roleplaying as therapeutic methods, which creatively support individuals. "Shatterproof" looks at healing through Scarlett, the female protagonist, as she navigates the complexities of her relationship to her past, herself, and her childhood best friend. She grapples with fear, identity, and truth. "Shatterproof" uniquely approaches trauma resolution through the surprising vehicle of theatre. I was intrigued by how while our body intricately works to adapt and protect us, sometimes the coping and defense mechanisms learned at an early age, which once protected the child, can actually transform into maladaptive habits in adult survivors. This play is the final project for my Richter Scholarship, integrating the interdisciplinary nature of my research surrounding my two majors, psychology and theatre, in a creative, new, insightful way – and on three different levels: the macrocosm (using psychology research to produce something for the theatre), the mesocosm (psychodrama's role specifically within the context of this play), and the microcosm (how the act of writing this play in some ways was the practicing of a psychodrama for its author).

Poster #65**Flavonoid Production and Acute High Temperature Stress in *Arabidopsis thaliana***

Suprene Mohamedzein

Major: Biochemistry and Molecular Biology

Mentor: Gloria Muday, Biology

The rate of global temperature increases has intensified in recent decades, challenging agricultural productivity as plants experience altered development and are at greater risk of death under these conditions. Reactive oxygen species (ROS) are important for intracellular signaling and are synthesized in greater amounts in response to abiotic stressors, including elevated temperature. Plants reduce excess ROS to maintain homeostasis by synthesizing antioxidant molecules called flavonoids. Mutations in genes encoding the enzymes at each step of the flavonoid biosynthetic pathway can be used to study the function of these molecules. The mutant *tt4* has a nonfunctional chalcone synthase gene (CHS), which encodes the first enzyme in the pathway, resulting in no flavonoid production. To observe the relationship between flavonoid synthesis and elevated temperature in plant vegetative tissues, *Arabidopsis thaliana* seedlings were exposed to acute high-temperature stress. *tt4* seedlings were found to have variable responses to heat treatment but were generally more sensitive to heat treatment compared to the wildtype Col-0. Heat-treated seedlings had reduced chlorophyll and carotenoids levels in both genotypes, with more dramatic changes occurring in *tt4* compared to Col-0. Anthocyanin and flavonol levels increased in Col-0 in response to heat treatment, where naringenin, isorhamnetin, and quercetin levels increased and kaempferol levels were maintained. To obtain more consistent heat stress phenotypes, a more heat-sensitive system will be utilized. Due to the temperature sensitive nature of plant sexual reproduction which reduces grain and fruit yields, current studies are asking whether flavonols protect *Arabidopsis* pollen from heat stress.

Poster #66

Icelanders and Volcanoes: From Pragmatism to Entertainment

Libby Mohn

Major: History

Mentors: Penelope Sinanoglou, History and Miles Silman, Biology

Icelanders inhabit a unique environment formed by volcanic activity. I was drawn toward better understanding the resulting relationship between Icelanders and the volcanoes that continue to shape their homeland while writing my History thesis. How have Icelanders understood and interacted with volcanoes in the past? In what way do Icelanders interact with volcanoes today? I traveled to Iceland with the Richter Grant to answer these questions. While in Iceland, I conducted informational interviews with professors and researchers on their studies of Icelandic folklore, volcanic monitoring, and Icelandic history. I also toured museums which explained the geological theories of volcanoes and documented volcanic activity in Iceland. Visiting physical sites allowed me to witness how eruptions had affected the land. Ultimately, I discovered that in the wealth of Icelandic folklore and myth, there was an utter lack of reference to volcanic activity. Instead, eruptions were mentioned in practical reports describing their effects on livestock and farmland.

Icelanders took a mostly pragmatic approach to eruptions because they had to adapt their farming lifestyle to the consequences for survival. Beginning around 1600, Icelanders stressed their practicality to avoid being seen as an exotic outsider by European nations. Today, Icelanders view volcanoes as entertainment. They watch eruptions on TV, travel to the site to experience the event, and enjoy the tourism that volcanoes have created for their country.

Poster #67

Making Monsters in Neo-Assyrian Palace Art

David Mulder

Major: Interdisciplinary Major in Ancient Near Eastern Studies

Mentor: Leann Pace, Study of Religions

The wall relief sculptures of Neo-Assyrian palaces, dating between the ninth and the seventh centuries BCE, are among the most famous works of ancient Mesopotamian art. 19th-century excavators removed most of the sculptures from their sites of origin and dispersed them among various museums and the art market, with the result that anyone now wishing to study the reliefs must virtually piece together fragments of the complete programs in collections across the world.

With the aid of a Richter scholarship, I was able to travel to museums in London, Oxford, Paris, and Berlin to do exactly that. I focused my research on the creation of composite monstrous creatures in Neo-Assyrian sculpture, initially trying to trace the origins of monstrous iconography in Assyrian ritual practices. As my travels exposed me to the original artworks, however, I began to turn away from the more customary iconographic and semiotic readings of the sculptures as a tightly controlled iconographic program. The subtle variations that I noticed in the sculptures' repetitive motifs led me to focus on issues of facture, the ways in which the sculptors' technical skills and knowledge influenced both the form and the meaning of the reliefs.

As a result of my observations during my summer travels, I am now pursuing further research into the working practices of the sculptors at Nimrud (ancient Kalhu), the earliest of the great Neo-Assyrian palaces, which will become the basis of my senior thesis in the spring.

Poster #68

Theatre as a Learning Tool for Socio-Emotional Development

Cassidy Noble

Major: Theatre

Mentor: Cynthia Gendrich, Theatre

Since its birth, the value of theatre as a means of achieving emotional connection and release has been recognized, particularly as it concerns experiencing catharsis and relating empathically with characters. Theatre has also recently been applied with success towards the therapeutic practices of dramatherapy and psychodrama. Inspired by theatre's rich history and uses, I set out to investigate the question of how its elements can be applied toward the creation of a therapeutic experience. I explored psychodramatic techniques through attending and participating in conferences and workshops led by experts in the field, and compared what I learned from these resources with insights gained from experiencing theatre in its traditional form. Through attending and analyzing live performances, I examined how a production is able to inspire hope, give relief to an audience, and treat tragic or negative events in a cathartic and healing way to provide an overall therapeutic encounter. I synthesized all that I learned through my research into a curriculum for a drama-based sanative program promoting the development of socio-emotional skills in middle school students, as well my own original play written with the intent of providing a healing experience as described above.

Poster #69

The Aversive Effect of Ethyl Pentanoate and Ethyl Hexanoate on the European Nightcrawler, *Eisenia hortnesis*

Mariel O'Connor

Major: Biology

Mentor: Cecil "Jake" Saunders, Biology

Earthworms are an essential feature of the environment as their contributions include the breakdown of waste, aeration of soil, and promotion of plant growth. For such an important organism, there is little known about the conditions that attract them. Prior data suggests that many earthworm species feed on the fungus *Geotrichum candidum*, commonly found in soil. We have conducted experiments that suggest the European nightcrawler, *Eisenia hortnesis*, avoids two compounds produced by this fungus, Ethyl Hexanoate (EH) and Ethyl Pentanoate (EP). In order to test if these compounds were aversive to *E. hortnesis* we used a burrowing assay. In this assay, 800 mL of desiccated soil was mixed with 200 mL of 0-40 mM EH or EP in spring water and distributed among cups. Worms were then placed on the soil and the position of their head was recorded after 10 min. In the spring water controls, almost all the earthworms burrowed; however, if an aversive compound was added to the soil fewer earthworms burrowed. Both Ethyl Pentanoate and Ethyl Hexanoate were found to be aversive to *E. hortnesis* in a dosage dependent manner. These results further our understanding of which habitats repel *E. hortnesis* and increase our ability to predict their behavior in certain soil conditions.

Poster #70**Elucidating Ime4: Effects of an m⁶A "writer" on meiotic transcripts in *Schizosaccharomyces pombe***

Callie Ollish

Major: Biochemistry and Molecular Biology

Mentor: Ke Zhang, Biology

Methylation of the sixth position of adenosine, or m⁶A, is an mRNA modification that serves a variety of functions in humans and other eukaryotes. Characterization of the various "writers" and "readers" of this modification has proven its role in regulating cellular metabolism by affecting processes like cancer or obesity. Meiosis is a process of cell division by which gametes are created for sexual reproduction. When in a nutrient-deficient environment, yeast use meiosis as a survival mechanism, creating a spore of four gametes and exchanging genetic material to increase their chances of survival. In budding yeast, Ime4 was characterized as an m⁶A writer, promoting meiosis by stabilizing necessary mRNA transcripts. It is unknown whether m⁶A modification exists in fission yeast, although it does have an Ime4 ortholog. Deleting ime4 in fission yeast results in an extreme sporulation defect, indicating that Ime4 plays an important role in meiosis. I found that Ime4 genetically and physically interacts with Red5, a member of the MTREC complex that targets meiotic transcripts to the exosome for degradation during mitosis. Ime4 also genetically interacts with Rrp6, the nuclear specific subunit of the exosome. These data are consistent with a model where Ime4 modifies meiotic transcripts and recruits Red5 and the MTREC complex, causing degradation of the meiotic transcripts during mitosis. Since MTREC complex is conserved from fission yeast to human but missing in budding yeast, my results may reveal a new functional connection between an m⁶A "writer" and the surveillance of meiotic transcripts.

Poster #71

A Dive Into Expressionism and Naturalism: The Resilient Voices For What May Otherwise Go Unsaid

Habby Olusesi
Major: Theatre

Mentor: Sharon Andrews, Theatre and Dance

This summer, I had the opportunity to travel to London and New York, studying the ways Naturalism and Expressionism operate in theatre. I researched figures who were forerunners in these fields, such as Zola, Stanislavsky, Ibsen, Strindberg, and Chekhov among others. I went to a number of locations for foundational research into these people and styles, including the British Library, The Victoria and Albert Museum, and The Hastings Museum and Art Gallery.

These locations provided a wealth of resources where I found enlightening written and photographic materials. I was also privy to archival materials such as journal entries from Strindberg, letters from Zola, and transcripts from rehearsals with Stanislavsky.

I then attended several theatrical productions that had elements of Naturalism or Expressionism. With each production, I took notes on the various written, casting or production choices that heightened either style, as well as how effective those choices were for me as an audience member. With all of the shows I saw and all of the research I did, I then wrote two short plays with the same central theme, where one was in a Naturalistic style, and the other was Expressionistic. I am now in the process of producing both short plays as a cohesive production to be showcased at the end of the semester.

Poster #72

Jaleca: Archaeology of an Upper Paleolithic Camp Site

Robert Outland

Major: Anthropology

Mentor: Paul Thacker, Anthropology

A major geophysical survey of the Sesmarias hill slope by Dr. Thacker and colleagues indicated the possibility of buried archaeological remains at a location called Jaleca. As part of the 2019 Wake Forest Archaeological field program in Portugal, we conducted early test excavations to determine 1) if a buried site was present, 2) if so how old the site is, and 3) to determine the function of the occupation of the site. Excavations were organized by a North/South grid with individual units placed across the hill slope in order to sample a large portion of the possible site. Recovered artifacts were analyzed at our field laboratory and placed into categories based on raw material, morphology, and artifact type. Stratigraphic data indicate that a buried concentration of artifacts occurs at a depth of ~30-40 centimeters below surface. We were able to attribute the site of Jaleca to the late Magdalenian period based on diagnostic tools including burins, endscrapers, and microburins. Assemblage attributes including a high tool to flake ratio support the hypothesis that Jaleca was occupied for a short period of time, perhaps no more than a week. Previously prepared tools were resharpened at the site with only exhausted tools and cores discarded. The archaeology of Jaleca reveals important details about the highly mobile foragers of Portugal during the last Ice Age including their efficient stone tool technology and practices of conserving raw material.

Poster #73

Synthesis of novel substituted gold-phosphine ligands and their behaviors in alkyne and alkene reduction chemistry

Tucker Payne

Major: Chemistry w/ Biochemistry and Mathematics

Mentor: Amanda Jones, Chemistry

In this increasingly environmentally conscious era, there has been a movement to reduce harmful contaminants produced as chemical byproducts. Many industrial processes involving alkynyl and alkenyl reductions traditionally performed with mercury compounds have been found to be alternatively operative using the much safer gold catalysis. In the study of this gold-ligand catalysis, the electronics and sterics of the phosphine ligands bound to the gold are important in optimizing and understanding the reaction mechanistically. Thus, the goal of this research was to synthesize di([1,1'-biphenyl]-2-yl)(phenoxy)phosphane ligands with various substituents bound to the 1'-phenyl or with alternative secondary ring structures. The p- methoxy, p-dimethylamino, and pyrrole were the primary focus. The syntheses required the optimization of reaction conditions, of purification techniques, and of recrystallization methods. Studies of crystal structures, NMR spectra, and gas chromatography mass spectrometry allowed for insight into the metal-ligand structural relationship, the stability of the gold complexes over time, as well as the efficacy of the various complexes as catalysts in the popular reduction reactions. While kinetic studies were not permitted in the timeframe of 10 weeks, the development of the synthesis strategies allow for later investigation to be more efficient. From this, trifluoromethyl and isopropyl substitutions are the next steps in achieving a full view of the reaction at hand.

Poster #74

Multicultural Influences & Developments in Berlin's Fashion Scene

Riley Phillips

Major: German

Mentor: Alyssa Howards, German and Russian

With a history of industrial contributions and a bustling, creative capital, Germany has acted as a hub for creative and textile developments for centuries. Influences from media and chemical advances of the 1700s and 1800s paved the way for Germany's origins in the textile industry, while waves of history exposed Germany, and notably, Berlin, to influences and post-war opportunities which framed outlets for social and creative expression. The unique position of Berlin, a city which has experienced intense phases of isolation, recognition, and public engagement within the recent century, has shaped it into an economically and socially diverse environment.

Through my research in Berlin, Germany, I sought to explore these influences and developments of multiculturalism in Berlin's fashion scene. I further sought to contextualize this research within the effects of the city's recent histories, the complexities of the professional fashion industry in Berlin with the city's non-status as a global fashion epicenter, and the current motivations of the industry which show promise of growth and attention within youth culture and sustainability.

As a city with a globally recognized, though not impactful, fashion week, Berlin's strongest fashion influence lies not in this professional industry, but rather, the social and cultural spaces accessible to the variety of people contributing to Berlin's creative melting pot. In my report, I discuss the status of Berlin as a center spurred by creativity, promising artistic expression, and opportunity and therefore attracting diverse populations of burgeoning young and foreign creatives within an industry of widespread multicultural engagement.

Poster #75

Axonal degeneration following blast-simulated traumatic brain injury

Jordan Pizarro

Major: Health and Exercise Science

Mentors: C. Edward Dixon and Shaun Carlson, Neurological Surgery, University of Pittsburgh

With the increasing use of IEDs during Operation Iraqi Freedom and Operation Enduring Freedom, blast traumatic brain injury (bTBI) has become the predominant cause of combat related TBI. bTBI is caused by a sequence of atmospheric pressure changes following an explosion. Primary blast injury is produced by the pressure wave itself and subsequent injuries are characterized as secondary (being struck by projected objects), tertiary (trauma endured after being propelled by the wave), and quaternary (any other related injuries). Although initial studies have shown that primary blast waves can cause significant TBI, neuronal degeneration, and cognitive impairments, research is still being conducted to determine their true effect.

With axonal injury being a known marker of TBI, this study aimed to assess axonal degeneration in rodent brains following primary blast-simulated TBI. A 4-week chronic cohort, including rats subjected to mild (n=6) and moderate (n=6) blast injury, and a 72-hour acute cohort, including rats subjected to moderate blast (n=3) and sham (n=3) injury, were developed in an attempt to understand the effect of injury severity and time points. FD NeuroTechnologies Silver Stain Kit and Fluoro-Jade B were used to view axonal degeneration and injury in various brain sections of rats within each cohort. Preliminary data suggests that there is a region and time dependent response to primary blast-simulated injury, with the biggest effects in the frontal cortex and brain stem. While additional research is needed to refine the silver staining and quantification processes, these results give direction for the focus of future studies.

Poster #76

Relating Functional Connectivity to Working Memory in Moderate-Heavy Drinkers

Adam Polikoff

Major: Psychology

Mentor: Dale Dagenbach, Psychology

Studies of human brain functional connectivity examine which regions of the brain influence one another based on statistical firing patterns extracted from fMRI scans. The resulting functional connectivity networks have been used to predict different behavioral measures. For example, prior research has been able to use both resting state and task data to generate connectivity networks that have significantly predicted participants' scores on an attentional task and has even predicted clinical signs of ADHD (Rosenberg, 2016). The present study sought to determine whether functional connectivity networks might also be able to predict working memory in a somewhat atypical group of participants. Specifically, we studied 63 individuals who identified as moderate-heavy drinkers. Using the correlated activity of brain regions, we generated resting state and task state networks of functional connectivity from participants who completed a 2-back working memory task. The correlations between brain areas were correlated with working memory performance using the task state data. The resulting positive and negative correlations were used to develop positive and negative networks based on those that significantly predicted participants 2-back scores, $r(61) = .916$, $p < .001$. However, we were unable to use the same connectivity data to predict working memory performance from resting state. Further, these connections were not predictive of working memory in a different group of participants. This result could suggest that because these participants have a history of alcohol consumption, their working memory network may be different from that of a more typical participant pool.

Poster #77

The effects of low-density lipoprotein (LDL) on the mechanical properties of single fibrin fibers

Rich Pope

Major: Biophysics

Mentor: Martin Guthold, Physics

Blood clots serve an essential purpose in controlling the loss of blood in hemostasis, but the same reaction pathways can lead to clots that cause diseases (thrombosis), such as heart attacks and strokes. Past research established that low density lipoproteins (often referred to as 'bad cholesterol' or LDL) plays a key role in the formation of pre-thrombosis plaques. Other research has documented the mechanical properties of the blood clot. However, little research had been conducted on the effects of LDL on single fibrin fiber properties. We used a combined Atomic Force Microscope (AFM) and florescent microscope to measure the mechanical properties of fibrin fiber samples formed with and without the presence of LDL. While there was no statistical difference between the average rupture stresses of the two conditions, the single fibrin fibers formed in LDL had a significantly greater average rupture strain as compared to the pure fibrin group. The fibers formed in LDL had an average 271% extensibility while pure fibrin sample exhibited an average 156% extensibility. Additionally, both samples approached and ruptured at the same Young's Modulus, but the fibrin fibers formed in LDL approached this point more gradually. On the basis of these results, we propose a model of dosage-dependent LDL effects upon fibrin fiber mechanical properties to be tested further. In conclusion, this research suggests a novel pathway by which LDL affects the properties of blood clots – it makes them more extensible.

Poster #78**Structural Studies of Two tRNA Synthetases**

Meghan Pressimone

Major: Chemistry

Mentor: Rebecca Alexander, Chemistry

X-Ray crystallography permits deeper understanding of protein structure and function beyond experimental assays. Such is the case of *Mycoplasma penetrans* methionyl-tRNA synthetase (MpMetRS), a homodimer comprising both an aminoacylation domain and an appended aminotransferase domain. It has been determined that the transferase domain of MpMetRS is capable of supplying methionine for aminoacylation activity, but the orientation of these domains relative to one another is unknown; elucidating the protein structure may reveal the evolutionary rationale for the linking of the domains.

Burkholderia cenocepacia tRNA-isoleucine lysidine synthetase (BcTilS), a tRNA-modifying enzyme, is of interest because of evolutionary mutants that increased bacterial fitness when TilS activity was actually decreased. Computational modeling and tRNA mutation experiments suggest a crucial recognition point at the 3-70 tRNA base pair, and crystallizing the enzyme, especially with tRNA, would better aid these conclusions.

In pursuing crystallography of BcTilS and MpMetRS, proteins have been overexpressed, purified, and concentrated. Through testing thousands of solutions varying in buffer, salt, pH, and polymer additive, deceptively promising salt crystals have precipitated. However, this trial-and-error process has accomplished a level of familiarization with both crystallography and X-ray diffraction.

This project is still very much in progress, and since initial screenings, more promising methods have been employed. Currently, MpMetRS and BcTilS+tRNA^{le} are subject to systematic screenings at the Hauptman Woodward Biomedical Research Center (Buffalo, NY), with most promise for BcTilS. Cryoelectron microscopy, a structural method best for large molecules, is currently in testing for MpMetRS.

Poster #79

Additive Effects of Nitric Oxide and Far-Red Light on Thrombosis

Fernando Rigal

Major: Physics

Mentor: Daniel Kim-Shapiro, Physics

Nitrite, which was previously thought to be inert, acts as a storage pool for nitric oxide in the presence of deoxygenated red blood cells (RBCs) and has potential for treating thrombosis. Fibrin fibers form the backbone of blood clots that are highly responsible for thrombotic conditions, such as Deep Vein Thrombosis. As shown by turbidity measurements recently, clots treated with nitrite and far-red light synergistically alters the kinetics of fibrin fiber formation as measured by optical turbidity to aid in thrombotic conditions. This study was done with platelet-poor plasma, however, so as to make it more biophysically relevant, it was extended to platelet-rich plasma. We hypothesize that far-red light (FR) potentiates the effects of nitrite on clot kinetics including clot lag time (CLT) and clot fibrinolysis time (CFT). Turbidity measurements of clot formation and clot lysis were performed on platelet-rich plasma samples with or without nitrite (10 μ M) as well as FR light exposure (660 nm) using a microplate reader spectrophotometer. It was found that clots treated with nitrite had a longer CLT prior to clotting ($p = 0.098$) as well as a considerably shorter CFT ($p = 0.025$). Furthermore, clots that were treated with nitrite and FR light had a significantly longer CLT than just the nitrite treatment itself ($p < 0.05$) while the dual treatment also elicited a shorter CFT ($p = 0.035$).

These results further indicate that the NO donor, nitrite, in hypoxic conditions, contains potential value for thrombotic conditions that could be enhanced with FR.

Poster #80

Reproducibility of Physiological Responses During Aerobic Exercise and Resistance Training in Overweight Patients with HFpEF

Tessa Roberts

Major: Health and Exercise Science

Mentor: Peter Brubaker, Health and Exercise Science

Previous studies have examined acute effects of aerobic exercise (AE) on heart rate (HR), oxygen consumption (VO₂), respiratory exchange ratio (RER), ratings of perceived exertion (RPE) and energy expenditure (EE) in patients with heart failure and preserved ejection fraction (HFpEF). However, little is known about acute physiological effects of resistance training (RT) in these patients. The objective of this study was to examine the reproducibility of common physiological values during AE and RT in HFpEF patients. Expired gas and HR data were obtained each minute using the COSMED K5 metabolic system, as well as RPE data, while participants (n=3) of the Studies Examining Caloric Restriction and Exercise Trial II (SECRET II) engaged in a bout of either AE alone or AE + RT training on two occasions, separated by 7-10 days. Data collected was averaged over the full bout (~60 min). Paired T-Tests were performed and level of significance set at $p < 0.05$. Paired T-Tests revealed no significant differences between Day 1 vs. Day 2 for HR ($101. \pm 13.1$ vs $100. \pm 18.0$ b/min), VO₂ (10.1 ± 1.34 vs 10.4 ± 1.52 ml/kg/min), RER (0.85 ± 0.03 vs 0.84 ± 0.03), RPE (10.5 ± 1.40 vs 10.8 ± 1.02), or EE ($190. \pm 74.1$ vs $191. \pm 67.3$ kcal) during bouts of AE and/or RT. These data indicate that older overweight HFpEF patients have reproducible acute physiological responses to AE and RT, and the COSMED K5 metabolic system can be used to quantify these responses.

Poster #81

The Mechanisms Underlying Affective Working Memory: Priming, Affect Labeling, and Implicit Emotion Regulation

Emma Rogers

Major: Psychology

Mentor: Christian Waugh, Psychology

People tend to be better at maintaining positive emotional states than negative emotional states, but the mechanisms underlying this pattern is still unclear (Waugh et al., 2018). We tested the possibility that people may be worse at maintaining negative emotional states because they are automatically regulating their emotion once the emotion-eliciting stimulus is gone. To test this hypothesis, we primed people nonconsciously to either regulate their emotions or maintain their emotions and compared these to a control condition. In a pilot study, we tested whether these nonconscious primes would influence people's natural reactions to emotional stimuli. The results suggest, however, that these primes did not influence people's natural reactions to stimuli. In a follow-up study, we plan to administer several implicit emotion regulation tasks including the numeracy bias in compassion task, the emotional stroop task, and the affect labeling task, with the affective maintenance task to examine whether individual differences in the propensity to automatically regulate one's emotions correlates with the failure to maintain negative emotional states. Currently, we are exploring the finding that labeling an emotional experience, or affect labeling, attenuates a person's emotional response (Lieberman et al., 2011; Constantinou et al., 2014). With the affective maintenance task, we are testing the possibility that implementing affect labeling directly after the first image will further lessen people's ability to maintain negative emotional states compared to content labeling and viewing conditions.

Poster #82

The Changing “Ethnoscape” of Venice: Human Mobility Flows in Times of Crisis

Alice Romanov

Major: Sociology

Mentor: Ian Taplin, Sociology

Venice, Italy, an ancient city grappling with the demands of crisis-stricken modernity, exhibits many of the characteristic issues of unsustainable tourism: an economic monoculture, environmental degradation, conservation issues, and major impacts on the host community, including displacement, unemployment, and loss of cultural heritage. Building off a previously conducted literature review of Venetian tourism, this study investigated changing patterns of human mobility flows (mainly the trilogy of residential exodus, touristic invasions, and the refugee crisis) in Venice and the impact of these changes on expressions of Venetian identity. Secondary quantitative data collection methods were used to analyze local literature and data on demographics, residency, policy, comparative housing prices, quantitative economic breakdowns, comparative employment trends and structure, social movements, and a content analysis of local media. Analyzed in relation to theories such as the tourism-induced change model, the data reveal a complicated narrative of a total restructuring of “Venetianness” due to the detrimental effects of exploitative industry, governmental inaction, changed political representation due to municipal reorganization, and the tangible effects of the climate crisis on Venetian livelihoods. While the centuries-old exclusive Venetian identity based on artisanship, cultural richness, and power is dying out under the heavy weight of mass tourism, a new collective identity is emerging, rooted in political activism, great environmental concern, and even civil disobedience. As one of the most highly visited cities in the world, Venice ought to be treated as a case study and a call to action for effective policy that prioritizes long-term flourishing over short-term profit.

Poster #83

Reconstructing the past: A comparative study of museum politics and memory in Portugal and Brazil

Juliana Rubinatto-Serrano

Major: Anthropology

Mentor: Paul Thacker, Anthropology

Museums have gone through an evolutionary process as it relates to their mission, from constructing national identity and justifying colonialism to comprehending its social responsibility and its power for social reform. Through this museology framework, I investigated how six museums in Portugal and Brazil, countries connected by their colonizer-colony history, are manifesting this transformation. Specifically, I analyzed their practices (and ideological foundations) that of colonialism and hegemony, that of universal ethics and globalization, and that of civic reform. The museums were paired for their analogous history, political mission and collection focus as follows: the Museu Nacional (Rio de Janeiro) and Museu Nacional de Arqueologia (Lisbon) for their long historical legacies, the Museu e Parque Serra da Capivara (Piaui) and Museu e Parque do Vale do Coa (Coa) for their focus on preservation and sustainable development, and the Museu Afro Brasil (Sao Paulo) and Museu do Aljube (Lisbon) for their concern with social justice and collective memory. I then collected evidence through historiographic research, detailed observation of exhibitions and visitor's guides, and stakeholder interviews. I developed a set of criteria for characterizing each museum's approach that could incorporate competing and complementing perspectives. A trinary diagram indicates that the results within museum pairs were homogenous, demonstrating the potential of this method of research for fostering discussion on how museums have and can use their authority in retelling the past.

Poster #84

Synthesis of Metformin-Based Nitric Oxide Donors

Daniel Santana

Major: Chemistry

Mentor: S. Bruce King, Chemistry

Metformin decreases circulating glucose levels and represents the front-line treatment for Type II diabetes of which 30.9 million people in the US are diagnosed (9.4% of the population). Despite the widespread use of metformin, a complete mechanism of how it elicits its effects remains unclear. Metformin impacts mitochondrial function decreases lipid accumulation, increases insulin/blood flow, decreases fatty acid synthesis and increases glucose uptake, all effects of nitric oxide (NO). The structure of metformin is relatively simple with the unsubstituted guanidine being similar to the guanidine group of L-arginine, the natural substrate of NO formation. Metformin-NO donor hybrids may show a synergistic effect between the typical effects of NO and metformin and potentially lead to better and different therapies for type II diabetes. Three synthetic routes were taken to synthesize Metformin-Based Nitric Oxide donors: preparation of a metformin derivative that mimics L-arginine, the substrate of nitric oxide synthase (NOS); preparation of a metformin derivative containing a known NO donor; and preparation of the nitrate salt of metformin. The unique metformin nitrate salt was prepared and confirmed by X-ray crystallography. Specific primary amines were prepared for an amino acid and nitric oxide donor metformin hybrid. However, combination with dicyanamide to yield the diguanidines proved difficult. Metabolic flux analysis of metformin nitrate shows a different profile from metformin hydrochloride suggesting a synergy. Future studies should be conducted on chemical and biological oxidation of metformin and these derivatives using a Nitric Oxide Analyzer (NOA) to directly detect NO, nitrite or nitrate, NO's oxidation products.

Poster #85

The Role of the Economy and the State in Constructing Restaurant Culture

Brennan Saul

Major: Economics

Mentor: Saylor Breckenridge, Sociology

In this project, I investigate how characteristics of the welfare state (e.g. universal healthcare, living wages, free education, and guaranteed retirement) affect job satisfaction and career development in the service industries. The comparison of the US and Denmark provides distinctions in state characteristics and the use of the restaurant industry allows for the examination of a non-elite profession with variable prestige characteristics. Distinctions between the US and Danish employment experiences will highlight how state-based services could be producing varied experiences of success and personal satisfaction in service industries. I conducted a cross-cultural interview study, collecting observational data, and interviewing a total of 44 restaurant owners and workers from 33 restaurant establishments. Twenty-three of the restaurant owners and workers are employed in the Capital Region of Denmark and 21 work in Chicago. I transcribed, coded, and analyzed the qualitative interview data and compared the findings to large-scale, cross-national, and longitudinal survey data from the European Values Study (EVS) and the World Values Survey (WVS) to find a relationship between individual workers' feelings about their experiences and data on national opinions toward work and family life. Preliminary findings reveal the following: 1) Worker experiences in restaurants in Copenhagen and Chicago are different 2) Unexpected similarities are also cross-culturally apparent; working in a restaurant promotes interpersonal growth 3) The key distinctions are that the social environment of the workplace is a leading parameter of competition among restaurants in Denmark, where in the US the primary parameter of competition is good pay.

Poster #86

An Erie Resemblance: Exploration of Eutrophication across Lake Winnipeg's North & South Basins

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Major: Biology

Mentor: Miles Silman, Biology

Named Berlin's Global Nature Fund's "Threatened Lake of 2013," environmental degradation and complete environmental destruction depicts Lake Winnipeg's latest, daunting reality. As potentially detrimental agricultural practices, wastewater discharge and hydrological management fail to prevent further harm to the health and wellbeing of the lake and its extensive watershed, the augmentation of current efforts is necessary in wholly understanding the environmental existence of Manitoba's Great Lake. Reflective of the inequities that continue to dissociate the many ecosystems affected, current mitigation strategies tend to lack a holistic perspective. Characterized by immense, harmful algal blooms across Lake Winnipeg's north and south basins, eutrophication has equated Lake Winnipeg to the environmental fate of Lake Erie when it was declared dead nearly forty years ago. An extensive integration of literature review, interviews with professionals in the field and direct interaction with Lake Winnipeg and its watershed, this study aims to understand that very resemblance; remarkable similarities and differences aside, with improved wastewater treatment, continued community activism and environmentally-sensitive policy implementation, Lake Winnipeg presents the potential for immeasurable improvement. An exploration of the opportunity and respective ecological benefits that further research and scientific amelioration may provide, intervention and identification of effective mitigative strategies is imperative in ensuring the environmental success of Lake Winnipeg today and in the future.

Poster #87**Viral Influence on *Synechococcus* Aggregate Formation and Predator Response**

Sam Schwartz

Major: Biochemistry and Molecular Biology

Mentor: Sheri Floge, Biology

As one of the most prolific photosynthetic organisms in the ocean, the cyanobacterium *Synechococcus* play a vital, but little understood role in the transfer of carbon from the atmosphere to the deep sea through a set of processes known collectively as the biological carbon pump (BCP). Carbon dioxide is converted into cells via photosynthesis, and ultimately sinks to the ocean interior as phytodetrital aggregates, thereby sequestering carbon from the atmosphere for thousands of years and reducing climate warming. The impact of predators such as viruses and single celled zooplankton upon *Synechococcus* conversion into sinking particulate organic carbon (POC) and its export to the deep ocean is unknown. Using cultured model systems, we investigated the impact of viral infection (phage S-SSM5) and zooplankton grazing (dinoflagellate *Oxyhris marina* CCMP3375) on the formation of *Synechococcus* (WH8102) cellular aggregates and found that combined predation by both viruses and zooplankton resulted in the formation of large (>500 μm^2) aggregates not observed in other treatments. We also examined whether viral infection influences feeding by the zooplankton upon *Synechococcus*. Our simplified food web experiments revealed that viruses reduce the percent of protists mediated upon the cyanobacteria (with virus 39% \pm 6%; without virus 68% \pm 11%). Our data suggest that viral infection reduces zooplankton feeding upward trophic transfer of *Synechococcus* and enhances formation of large cell aggregates. This work highlights the underrepresented role of marine viruses in enhancing large particle formation and the efficiency of the biological carbon pump, potentially reducing the rate of climate change.

Poster #88

The Social Stigma Surrounding Mental Health Issues in Kathmandu, Nepal

Yassmin Shaltout

Major: Anthropology

Mentor: Steve Folmar, Anthropology

Developing mental illness is more likely for individuals who live under disadvantaged conditions; thus, Nepal's political instability, frequent natural disasters, and economic hardship have caused people to be very likely to experience mental unwellness. While only 3% of the Nepali national budget is assigned to tackling health issues, 1% of that budget sub-set is given towards mental health. This limited attention is partially due to the social stigma which has led to these institutional disadvantages. This study in particular was conducted in the city of Kathmandu and aims to better understand the conceptual relationship between Nepali ideas about stress and the western medical concept of anxiety disorder. In order to better understand the roots behind the stigmatization of mental wellness issues, the opinions of 39 Nepali individuals on mental wellness, happiness, and spirituality were collected through semi-structured interviews. One subject is a mental health provider, the remainder of the participants are divided into individuals who are educated in a western college system and individuals who did not experience a college education. It was found that those with a western college education were more likely to use western biomedical labels when describing issues surrounding mental wellness and this branding affecting their conceptualization of the stigma. Buddhist ideas on releasing worldly desire also played a great role in the conceptualization of stress and anxiety. By gathering a better understanding of these concepts, one can bring diverse cultural knowledge into healthcare practices and into advocacy efforts for mental health equality.

Poster #89

Analyzing K-mer graphs of Peroxiredoxins using deep learning model

Pengyi Shi

Major: Computer Science

Mentor: William Turkett, Computer Science

Oxidative stress is a factor in a number of diseases, so understanding the function of the Peroxiredoxins, proteins which play roles in redox regulation, is important. Based on sequence and structure similarity, there is evidence of six Prx sub-groups, with one of those able to be further subdivided. Our hypothesis is that sequence information, in the form of a k-mer graph, can be used to distinguish between Prx sub-groups. A k-mer graph represents which k-mers (small regions of protein sequences) are shared between a set of proteins.

We cleaned, converted to k-mer representations, and constructed and visualized k-mer co-occurrence graphs for 14,000+ protein sequences. This was done with Java and Python programs and the use of the Neato graph drawing software. We then configured and implemented convolutional neural networks using Tensorflow to learn a classifier to differentiate between k-mer graph images built from the Prx1 and PrxQ sub-group proteins. Variations on the images, including coloring nodes based on k-mer, adjusting edge lengths based on co-occurrence rates, and removing sets of edges were explored to determine what the essential features were for a successful classifier.

The learned classifiers achieved over 98% accuracy in distinguishing between images of k-mer graphs from the two sub-groups, and analysis of the key graph features is helping to identify distinguishing k-mer communities. The next steps in this work include further exploration of deep learning tools, expansion of the classifier to differentiate more than two Prx sub-groups, and additional investigation into the distinguishing sets of k-mers.

Poster #90

Neural Substrates of Inhibitory Control Maturation in Non-human Primates

Leonardo Silenzi
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Mentor: Christos Constantinidis, Neurobiology and Anatomy,
Wake Forest School of Medicine

Inhibitory control matures through adolescence and into early adulthood, impacting decision-making. Impairments in inhibitory control are associated with various psychopathologies, many of which emerge during adolescence. In this experiment, we examine the neural basis of developmental improvements in inhibitory control by non-human primates, identifying the structural and functional specialization of executive brain systems that mediates cognitive maturation. For this experiment, we trained four Macaque monkeys in two tasks: working memory task and antisaccade (AS) task. The trainings started when the monkeys were 2.5-3 years old, before the onset of puberty at ~3.5 years old. We have found evidence that there is an impairment in the capacity of the monkeys to succeed in working memory and AS tasks.

The monkeys are able to succeed in the working memory tasks from an early age but have difficulties performing the AS task. We are currently collecting data to detect the structural anatomical changes in the brain and systems-level connectivity changes that may cause this impairment.

Poverty and Capabilities

Madison Sinclair

Major: Philosophy

Mentor: Win-chiat Lee, Philosophy

Non-governmental organizations (NGOs) work with some of the most vulnerable people in the world. This grants NGOs not only great power, but also great responsibility. Developmental aids and NGOs related to poverty usually focus on providing functional opportunities (such as education or other opportunities that shift power dynamics) or tangible benefits (such as clothes or food) to those they serve. In this project, I propose that their goals be re-oriented toward building capabilities, which Stanford Encyclopedia of Philosophy defines as providing people with “real opportunities to do and be what they have reason to value.” Through volunteering for and researching various NGOs in New Delhi and Mumbai, I intend to define the criteria for an NGO to use its resources according to the capability approach as it specifically applies to NGOs in India. In doing this, I will apply the ideas of Amartya Sen and Martha Nussbaum to a real-life issue to produce research relevant to communities both here and abroad.

Poster #91**Synthesis of 5-deazariboflavin-derived Coenzymes**

Simon Skeen

Major: Biochemistry and Molecular Biology

Mentor: S. Bruce King, Chemistry

Riboflavins are co-factors, compounds that assist enzymes in performing their tasks, and possess many diverse chemical properties. F420, and F0 are 5-deazariboflavins, meaning they lack the normal nitrogen atom in the fifth position, instead replacing it with carbon. 5-Deazariboflavins are very interesting molecules due to their diverse of functionality and uses in biochemistry. One function they possess is the ability to reduce nitroimidazole antibiotics, though the exact method and nature of this reduction and all of the resulting by-products have yet to be identified. I attempted to synthesize F0 for use in experiments to determine its redox properties and chemical reactions with nitroimidazole antibiotics. Normally F0 and F420 are enzymatically synthesized enzymes in organisms such as the bacteria *Mycobacterium smegmatis*. The molecules can then be extracted and isolated from cell cultures to procure a usable sample. In our attempt to produce F0 from a bacterial culture was somewhat impractical based on the sheer scale required to produce such a sample. My attempt to synthesize F0 by a five-step route was more successful, with the proposed molecule being confirmed by mass spectrometry. Purification of F0 from the last reaction step is quite difficult and thus a usable sample of F0 has yet to be obtained. Oxidation poses a complication to many of the intermediate steps in the reaction pathway of F0 synthesis yielding impurities that have prevented F0 isolation. Though in the future with increased efficiency and familiarity with the techniques I hope to produce a cleaner sample of F0.

Poster #92

Impact of smoking history on blood pressure trajectories during 24 hours post thrombectomy

Colton Smith

Major: Health and Exercise Science

Mentor: Stacey Wolfe, Neurosurgery, Wake Forest School of Medicine

Strokes are the most common cerebrovascular disorder and affects 800,000 Americans annually. A stroke occurs when either blood carrying arteries to the brain are blocked (ischemic) or a blood vessel leaks and bleeds into brain tissue (hemorrhagic), and leads to severe brain injury. Mechanical thrombectomy is one of the leading surgical interventions to treat ischemic strokes, by removing clots in cerebral arteries. Today, many thrombectomy studies investigate the control of blood pressure in the first 24 hours post operation as it relates to functional outcome of the patient after recovering. We investigated the trajectory of systolic blood pressure lowering during 24 hours post operation based on patient's past medical history of smoking (never smoker, former smoker, current smoker). We retrospectively reviewed the WFBMC Neurosurgery database of thrombectomy cases from January 2015- June 2019 treated with mechanical thrombectomy. Patients were grouped according to their PMH of smoking and hourly systolic blood pressures were extracted for 24 hours post intervention for each case. Of 236 patients, 95 were never smokers (40.2%), 92 were former smokers (39.0%) and 49 were current smokers (20.8%). Linear and non-linear SBP trajectories over 24 hours were significant between groups ($p=.01$ and $p<.0001$, respectively). Former smokers displayed a steady decrease in SBP over time, whereas both the current and never smokers decreased and then increased in a parabolic fashion. The never smokers decreased and increased SBP more rapidly than the current smokers did.

Poster #93

Computational Analysis of Genotype 2 Rotavirus Host Diversity: Potential Reassortment between Human and Animal Strains

Molly Sohn

Major: Biochemistry and Molecular Biology

Mentors: Sarah McDonald, Biology and James Pease, Biology

Rotaviruses are a leading cause of severe gastroenteritis in children, and infection results in up to 148,000 deaths annually. Rotaviruses contain an 11-segmented double stranded-RNA (dsRNA) genome, and each segment is assigned a specific genotype according to established nucleotide percent identity cutoff values. In addition to infecting humans, rotaviruses with genotype 2 genes also infect a wide array of animals. However, there are large gaps in knowledge about (i) the genetic similarities of rotavirus genotype 2 genes/proteins from strains infecting various host species, and (ii) the capacity of human and animal rotavirus strains to exchange genes by process of reassortment. In this study, we sought to elucidate host-specific genetic determinants for the genotype 2 genes of rotavirus. Full length nucleotide/amino acid sequences for each gene were downloaded, labeled according to pre-established lineages, and used to construct sequence alignments and phylogenetic trees. Our analysis revealed that despite a high genotype 2 rotaviral host diversity, the sequences do not explicitly cluster in a host-specific manner. The result was surprising and it suggests that genetic exchange may be readily occurring among human and animal rotavirus strains in nature. Aims of ongoing research in the McDonald and Pease labs include determining the genetic compatibility among rotavirus genes, quantifying reassortant frequencies, and mapping reassortment restriction determinants that prevent viral replication. This work is significant because it informs a basic understanding of rotavirus biology and it may provide a platform for predicting the emergence of novel rotavirus strains in the human population.

A Cross-Sector Comparison of Reconstructive Efforts after Hurricane Maria

Ciara Sotomayor

Major: Politics and International Affairs

Mentor: Sarah Lischer, Politics and International Affairs

In this investigation, I examine the aftermath of Hurricane Maria in Puerto Rico nearly two years after the storm to comprehend the factors influencing the recovery efforts and efficacy of humanitarian assistance from the United States to Puerto Rico. As a commonwealth with previous colonial relations with Spain and a strategic geopolitical position for the United States during the Cold War, the experiences of the small Caribbean island merit a reexamination of U.S. disaster policy following the storms of 2017. To develop a holistic understanding of the issues Puerto Rico faces during the process of reconstruction, I compare efforts in different sectors including the economy, infrastructure, public health, and energy.

Additionally, I include the history of Puerto Rico and analyze the current political problems, as well as how corruption and mismanagement affects their relationship with the United States. The major factors I identified affecting the recovery in Puerto Rico are the federal debt, recent alterations to existing disaster law, low climate resilience due to aging infrastructure, and ongoing corruption in the central government. To comprehend the gaps in community recovery in Puerto Rico, I also utilize photojournalism in multiple municipalities to show infrastructural damage and reconstruction. While the United States often offers assistance after disasters and during conflict, it is critical to examine the factors influencing these offers. A single natural disaster has great implications for the regional economy, migration and calls for an analysis of how responses to disasters can be adjusted to mitigate human suffering and damage.

Poster #94

Use of Artificial Intelligence to Identify Serengeti Animals

Caroline Spurzem
Major: Biology

Mentor: T. Michael Anderson, Biology

In this project, we explore the use of artificial intelligence (AI) to identify animals in the Serengeti from pictures in order to decrease human classification time. In particular, the Marco Willi (MW) empty and species models are used, which have been tested for Snapshot Serengeti data. Marco Willi achieved accuracies of 91.2-98% for the empty model and 88.7- 92.7% for the species model at the Snapshot Serengeti sites [Marco Willi et al. 2018]. Our goal is to apply these MW models to our own ten-sites in the Serengeti that have seven years of unclassified images starting in 2012. Then this large data set can be used to answer many biological questions such as my own which is how diversity in ungulates changes across the Serengeti in relation to rainfall, productivity, and NDVI.

Poster #95

When shooting backfires: killing gray wolves (*Canis lupus*) to protect livestock can lead to more livestock losses due to social disturbance

Aspen Stevanovski

Major: Biology

Mentor: T. Michael Anderson, Biology

Extirpated by the early 1900s and reintroduced in 1995, gray wolves (*Canis lupus*) are perhaps the most polarizing and controversial animal in the lower 48 United States. As is the case with most large predators, the fear of livestock predations is a major concern for many, despite gray wolves accounting for only 0.01% of annual American livestock loss (USDA 2015). Lethal control against wolves is a preferred method for many ranchers who cite immediate results and cost efficiency. However, studies have emerged demonstrating not only the efficacy of nonlethal prevention methods (livestock guarding dogs, fladry, etc.) (Stone et.al 2017) but also suggesting that the sociability, dispersion, and territoriality of social predators like wolves renders lethal control either neutral or positively associated with more livestock predations over subsequent years (Treves et.al 2016). In this study, multivariate analysis was performed on the largest collective data set on gray wolves in the lower 48, spanning 2009-2018, in order to determine which variables - categorized as human or natural - strongest predict increased cattle (*Bos taurus*) and sheep (*Ovus aries*) predations by wolves. Preliminary models have demonstrated that the percent of wolves killed the previous year to control for livestock is consistently one of the strongest predictors of both cattle and sheep attacks, and is positively correlated.

Poster #96

Genres Analysis of First Year Writing in the Discipline

Julia Stevens
Major: English

Mentor: Zak Lancaster, Writing

As a required course for WFU students, Writing 111 emphasizes the foundations of college-level writing. As stated in program planning documents, WRI 111 “provides students with space for [...] developing and reflecting on their own claims, evidence, and reasoning; connecting specific writing choices with rhetorical purposes and effects, and composing in various genres.” However, since the various sections of WRI 111 are uniquely designed, without uniformed textbooks or assignment sequencing, the purpose of this research was to explore points of coherence within this diversity – in particular, the kinds of assignments that cut across the various course sections. Our research was guided by three core questions: 1) What kinds and how many paper types are assigned? 2) What paper types span across sections? And 3) What are recurring assignment labels? To answer these questions, we compiled a database of WRI 111 syllabi from 2014-2019 and extracted all assignment labels. We then developed a taxonomy to categorize these into descriptive groupings, which included: reading response, textual analysis, argument-based, summary, narrative, metacognitive, personal, ethnography, and other. Our analysis revealed that textual analysis and argument-based are the most frequently assigned paper types. However, more assignment labels yet were not descriptive enough to be assigned a proper label, falling into the “other category”. This work lends itself to continuation, using the labels that have been created and sorted to inform the Writing Program as it seeks to better understand student writing across the curriculum.

Poster #97

Analysis of Pain Medications Use in Older Adults with Knee Osteoarthritis

Kiersten Stewart

Major: Health and Exercise Science

Mentors: Steve Messier, Health and Exercise Science and
Shannon Mihalko, Health and Exercise Science

Background: Knee osteoarthritis (OA) is the leading cause for disability in adults. Pharmacological treatment is the most common method patients employ to reduce pain and improve function; however, medication usage is seldom reported in clinical trials. The purpose of this study was to determine how pain medication use varied by gender, BMI class, and number of comorbidities in older adults with knee OA. **Methods:** The Strength Training for Arthritis Trial (START) was a randomized controlled trial in which 377 older adults with mild to moderate knee OA were randomized into either strength training or control groups. Here we report baseline medication use using a questionnaire adapted from the Atherosclerosis Risk In Communities (ARIC) study. Data were analyzed using a one-way ANOVA and independent t- tests to determine significance and frequencies. **Results:** Mean baseline characteristics of the participants included: age, 61.5 ± 8.1 years; BMI, 31.3 ± 5.4 kg/m²; % female, 60.7. Pain medication usage across gender was 72% for females and 74% for males, $p=0.58$. Medication usage across BMI classes was 83% for 20-24.9 kg/m², 69% for 25-29.9 kg/m², and 73 % for 30-34.9 kg/m², $p=0.22$. Total comorbidities were categorized into those with 1-2 comorbidities and those with 3-7 comorbidities. Pain medication use in participants with 1-2 comorbidities was 74% and for 3-7 comorbidities pain medication use was 72%. **Conclusion:** Pain medication usage was consistent across gender, BMI, total number of comorbidities in older adults with knee OA.

Poster #98

Changes for a Better Health and a Better Nation: Policy Reforms in Spain Based on the Catalanian HiAP Model

Samantha Strelzer

Major: Politics and International Affairs

Mentor: Sara Dahill-Brown, Politics and International Affairs

Since decentralization of Spanish government, questions have remained as to developing policy that effectively impacts both regional and national population. Spain has developed an efficient socialized healthcare program. Due to the decentralization process, however, certain regions of Spain have developed far more advanced policy mechanisms. In particular, Catalonia steps outside the traditional rolls of government oversight to forecast visionary policy and policy-making techniques. Amidst the tug of war between willingness and resistance to implement healthcare policies that have a dedicated impact on improving the population health and healthcare, Catalonia employs original thinking and innovation in policy using the Health in All Policies (HiAP) model to create comprehensive strategies. By integrating health into every policy put forth, Catalonia ensures decision-making that prioritizes citizen health first and foremost. When all shareholders are on the same plane, better conversations can be facilitated to better avoid potential issues. Health, as this policy paper explains, is aspect of life that interweaves all other socioeconomic factors. Policy changes must be introduced to improve communication and coordination amongst regions and on a national level, thereby introducing horizontal, collaborative partnerships. The accountability that exists as a main tenet of HiAP limits the presence of the free rider issue in government at all levels. This paper demonstrates the needed nuanced conversations that compel policy-makers to work together to further advance effective efficiency in socialized medicine.

Poster #99

Evolution of a new epigenetic trait in *Saccharomyces cerevisiae*

Samuel Sutton
Major: Biology

Mentor: Clifford Zeyl, Biology

In a previous experiment in which yeast populations adapted to a low-nutrient environment, three populations curiously lost the ability to grow on a nutrient-rich medium. They regain, and lose again, this ability at rates much higher than typical mutations suggesting that the 'switching' trait is epigenetic. In the low-nutrient medium, the yeast were fitter than when they were in the state of being unable to grow in a nutrient-rich medium, and the switching trait evolved during a period when there was a tradeoff between fitness in poor and rich media, suggesting a trait that is not only epigenetic, but adaptive also.

To more definitively prove this, yeast genome sequence data was obtained for the colonies. The output from that was run through a pipeline to view the final alignment in .vcf form using a software called IGV. The software displayed one consensus sequence with three lines of amino acids marked with any spots of possible indels or substitutions which was not intended. Initially the filtering in the pipeline was too relaxed and had to be increased to more selectively locate snps, but even further filtering proved to make little difference. One particular function of samtools known as tview proved to be exactly what was needed.

Comparing previously marked locations with potential mutation sites found no similarity. This suggests further that the yeast displays an epigenetic switching trait due to the fact that any likely contributing genes were found to have no mutations that would cause a change in amino acid.

Poster #100

Analysis of Odor Effects on a Honey Bee's Perception of Sweetness

Seth Tennant

Major: Biology

Mentors: Susan Fahrbach, Biology and Stephanie Hathaway, Biology

Apis mellifera (European honey bee) is a foraging insect naturally exposed to many concentrations of sucrose and different floral odors in search for food, making them useful subjects for this project. This project analyzed the responses of the honey bees to different concentrations of sucrose in an environment containing odors derived from plants they might encounter during foraging. The motivation for this research was to ask if the presence of odors influenced the perception of sweetness, testing specifically if any such effects were innate. Honey bees, reared in laboratory cages to prevent prior uncontrolled experience with floral odors, were harnessed and placed in a controlled environment containing one of five odors: Limonene, Geraniol, 6-methyl-5-hepten-2-ol, and Linalool. An environment lacking odor was used as a control. Honey bee's antennae were touched with varying concentrations of sucrose and using PER, the reflexive extension of a bee's proboscis indicating the perception of sugar, individuals were given a Gustatory Response Score (GRS) based on their performance. In contrast to prior results indicating a facilitatory effect of some odors on sucrose perception in hive-reared honey bees, the data obtained did not provide evidence that honey bees were strongly influenced by any of the tested odors. However, the data were in accord with prior results in showing a slightly higher GRS in the presence of the floral odors Geraniol and 6-methyl-5-hepten-2-ol. It is possible that the effects detected in the earlier study reflected experience of odor-sugar associations gained during foraging.

Poster #101

The Lure of Irish Folklore: How Ireland's Past has Impacted Present Day Ireland and Southern Appalachia

Whitley Thomas

Major: Psychology

Mentor: Jefferson Holdridge, English

From late May until early July, I spent six weeks traveling throughout Ireland immersing myself in Irish folklore in an attempt to understand some of my own Appalachian roots. One of the main goals of my research was to redefine my schema of folklore. In doing so, I found that folklore can serve as a broad, encompassing term with many subdivisions that explain how people lived and live their everyday lives. With my presentation, I will focus on the people and places that impacted me the most. I have created a black and white photo collage that features all of those who contributed to my journey in their own unique way; some by sharing their own stories of experiences with the mystic beings of Irish folklore, some by sharing how they have devoted their lives to studying and preserving Irish folklore, and some by sharing their own family histories that play into the greater history of Ireland and thus immensely impact Irish folklore. The poster also features a map of my travels containing pictures of the most memorable places along the way. Alongside the poster, the presentation features audio recordings of stories, traditional Irish music, and video footage. This project is only the beginning of what has the potential to be so much more. My immense gratitude goes to the Paul K. Richter and Evalyn E. Cook Richter Memorial Funds and the Wake Forest Richter Scholars Program for supporting my travel and research this summer.

Poster #102

**A Study of Late Woodland Piedmont Village Tradition
Lithic Economies through Experimental Replication of
Triangular Projectile Points**

Garrett Toombs

Major: Anthropology

Mentor: Eric Jones, Anthropology

This study explores the lithic economy of Late Woodland Piedmont Village Tradition communities through examining attributes of rhyolite flakes from projectile point production at the Redtail (31YD173) site. We build on Andrefsky's (1986) study of flake curvature through experimental replication of generalized triangular points and apply it to specific types found at Redtail. We examined over 300 flakes recovered from two loci and then produced and measured flakes from replica triangular points for comparison. Our results provide clues as to what stage of lithic reduction was occurring at Redtail and how the material was acquired and used.

Poster #103

Do Legislative Gender Quotas Lower Corruption?

Natalie Valdes

Major: Politics and International Affairs

Mentor: Justin Esarey, Politics and International Affairs

Prior scholarship has established that increased participation of women in government, especially the legislature, can cause decreased corruption in that government in some contexts. An evident implication is that requiring female representation in the legislature through a quota should reduce corruption. However, gender quotas can be implemented in many ways and for varying reasons. Some of these implementations may deliberately or inadvertently eliminate the efficacy of women to fight corruption. In addition, corruption may cause a government to implement gender quotas in response to international and domestic pressure or as a means of clientelism; this fact muddies the interpretation of any empirical relationship between quotas and corruption. In this paper, we examine cross-national time series data using research designs intended to identify any causal relationship between legislative gender quotas and corruption.

Poster #104

The Inequalities in French Education As a Result of its Transition to Decentralized Politics

Hannah Vaught

Major: Interdisciplinary Studies: Philosophy of Education

Mentor: R. Scott Baker, Education

This research presents a synthetic picture of the educational inequalities in France that have been exacerbated as a result of the country's transition to decentralized politics. With the Decentralization Acts of 1982 and 1983, and 1985, the French state has moved away from its highly centralized and authoritarian political administration center to tiers of regional, departmental, and municipal assemblies. This legislation reformed the educational landscape by introducing greater diversity and more flexible organization to a uniform educational system. However, the autonomy prescribed is being practiced through what are still relatively new policies that grant a significant increased role of the elected local authorities in the academic regions of the country.

The goal of education in France is to pursue equal opportunity in schools by providing the same education to every student enrolled with no discrimination to the socioeconomic status or origin of the student. What has emerged, however, is an educational system that is still in transition, so that the problem of growing disparities is the result of both a centralized and decentralized political agenda. In consequence, the French are currently facing even more inequality in a system that is becoming more complex, autonomous, and decentralized. As a result, public schooling in France no longer exists as a way to climb the ladder of social mobility despite the politics that are written with this goal in mind.

Writing Moves: An Online Journal of Wake Forest Student Writing

Abby Vogeley
Major: Biology

Mentors: Elisabeth Whitehead, English and Anne Boyle, English

The purpose of "Writing Moves: An Online Journal of Wake Forest Student Writing" is multifaceted. Primarily, it serves as a collection of student written pieces selected by Wake Forest writing professors as exemplifying aspects of writing to be admired. In addition, it may be used in a pedagogical manner, enabling faculty to use student writing as a teaching tool in college classrooms and as models of various writing styles and skills. The journal is primarily targeted towards students in the entry level writing classes, and its contents are nominated to be included by faculty who admire the student author's piece. Once these essays are nominated, it is the duty of the student editor, who has the familiarity and perspective of a student writer, to work with the faculty editors to determine which essays will be included in the journal. Once determined, the student editor and faculty editors work alongside the selected student writers as they provide encouragement to edit and polish their essays. The student editor, as well as the faculty, provide commentary and annotations for each essay.

Additionally, the student editor incorporates technical skill to publish the journal online.

Poster #105

Examining Late Woodland Piedmont Village Tradition Social Interactions through Ceramic Analysis

Alyssa Walton

Major: Anthropology

Mentor: Eric Jones, Anthropology

This project compares ceramic attributes among six Piedmont Village Tradition sites in the upper Yadkin River Valley, 1200-1500 CE. We use these data to examine potential social interactions among these communities, and the relationship between two loci at the Redtail site. 350 sherds were classified based on attribute combinations and compared using Brainard Robinson Coefficient analysis. The two Redtail loci looked most similar suggesting a strong connection between dispersed areas of activity. Patterns of similarity among the other sites are not based solely on geographic proximity and may correspond to women's interaction networks or women's movement on the landscape.

Poster #106

A Transfer Learning Approach for Biological Image Classification

Katherine Wang

Major: Computer Science

Mentors: V. Paúl Pauca, Computer Science and Miles Silman, Biology

We trained and applied an object detection model (YOLO) for classifying Snapshot Serengeti data. A 72.127% accuracy rate was obtained by transfer learning, matching or improving upon the state of the art. This promising result will help research efforts at Wake Forest, Biology Department. In future work, we will consider adding additional attributes identifications, such presence of young and behavior (eating, standing, resting, etc.).

Poster #107

The effect of elephant made crude woody debris on African ungulates in the Serengeti National Park, Tanzania

Madeleine Ward

Major: Biology

Mentor: T. Michael Anderson, Biology

When African Elephants push over and uproot trees to access the water and nutrient rich roots and leaves, they create crude woody debris (CWD). In doing so, they modify African Savanna landscapes in various, dynamic ways. This landscape modification and the effect it has on the plant community has been thoroughly studied. However, elephant modification's effect on other animals has been largely unexplored. Elephant created CWD increases the available browse for mixed feeders, such as impala, and creates habitat for hider type antelope, such as reedbuck. However, since the apex predatory of the system, the lion, uses obstructions such as CWD to hunt, they may also be creating patches of fear. Therefore, I hypothesize that: (a) 'Runner type' grazers avoid CWD and that the avoidance will be less for herbivores of a larger guild size. (b) 'Runner type' mixed feeders will be present in higher densities in the areas around CWD than in the areas around unmodified trees, independent of guild size. "Hider type" herbivores will be present in higher densities in the areas around CWD than in the areas around unmodified trees, independent of guild size. To test this, I fist compared grazing and browsing pressure around CWD and standing trees. Then, I set up trail cameras to monitor the before and aftereffects of simulated CWD creation. Preliminary results support my hypotheses and show that 'Runner type' grazers are avoiding CWD whereas 'Runner type' mixed feeders are utilizing the increase in browse.

Poster #108

The development of epidermal sensory organs in *E. hortensis*

Hannah Watson

Major: Undeclared

Mentors: Wayne Silver, Biology and Cecil "Jake" Saunders, Biology

Earthworms enhance soil quality and promote plant growth, yet little is known about how they detect stimuli in their environment. We are interested in the sensory structures which detect environmental stimuli and how they develop. The cells assumed to be responsible for detecting environmental stimuli are clustered in structures known as epidermal sensory organs (ESOs). This investigation used scanning electron microscopy (SEM) and florescent confocal microscopy to determine if ESOs are present at various stages of earthworm development. Samples of the prostomium (nose) were taken from neonatal, 6-week-old (adolescent), and adult earthworms. While the ESOs can be counted on the epithelium without special tagging with SEM, to view them with a confocal microscope, the sensory organs were treated with antibodies that tagged acetylated tubulin, a key structural component of ESOs.

Samples at every age point showed evidence of ESOs, both in the SEM and florescent images.

Additionally, we found that the sensory organs on neonatal samples were 5-7 μ m in diameter, while the adults averaged 10 μ m in diameter. This suggests that earthworms have the capacity to sense their surrounding immediately after they emerge from their cocoons through adulthood, and also is evidence that their ESOs grow during development. To determine how this change manifests itself, we will begin counting the number of sensory organs on the prostomium and conduct assays to measure the how sensory organ changes effect behavior.

Poster #109

The Effect of Elite Rhetoric on Individuals' Attitudes Toward Immigration and Immigrants

Lexi Webster

Major: Politics and International Affairs

Mentor: Betina Wilkinson, Politics and International Affairs

The purpose of this project is to examine the effects of elite messaging and in-group identity on individuals' attitudes toward immigration and immigrants in the U.S. We live in a world where U.S. immigration is a polarizing topic. Some individuals favor it significantly, while others do not and even support building a wall along the U.S.-Mexico border. We have a strong understanding of the economic, cultural and social factors that shape individuals' immigration stances (Wilkinson and Bingham 2016; Rouse, Wilkinson and Garand 2010), but our knowledge of how sports in-group identity and elite messaging on immigration affect attitudes toward immigration and immigrants is quite limited. In this study, I seek to examine specifically: To what extent are NFL Panther fans who are anti-immigration likely to change their stances on immigration (and become more in favor of immigration) if they are exposed to a dissonant and surprising message that is pro-immigration by an NFL Panther player or coach?

Poster # 110

Mechanism of Tumor Suppression of SPARC in Bladder and Ovarian Cancer

Michael White

Major: Biochemistry and Molecular Biology

Mentor: Neveen Said, Cancer Biology, Wake Forest School of Medicine

SPARC is an extracellular matrix protein demonstrated to have numerous tumor suppressor effects. The mechanisms by which these effects occur are largely understood. Here, we investigate the relationship between SPARC and two tumorigenic processes: harnessing inflammatory signaling and evading growth suppression. To investigate the former, we performed in situ proximity ligation assays and found that the NF- κ B subunit RelA. This information will lead us to investigate whether SPARC mediates this effect. To investigate growth suppression evasion, we performed immunoprecipitation on wild-type and SPARC knockdown lysates to determine whether SPARC forms a complex with several players in the cell growth pathway and found that it complexes with c-Jun, c-Fos, Hsp90, and RelA. This result will lead us to further investigation about the relationship between SPARC and growth evasion.

Poster #111

'Where Do We Go From Here?': Rethinking Race and Memory in Southern Civil Rights Museums

Emily Wilmink

Major: History

Mentor: Benjamin Coates, History

This summer I travelled to the National Center for Civil and Human Rights, the Legacy Museum and Memorial for Peace and Justice, the Birmingham Civil Rights Institute, and the National Civil Rights Museum at the Lorraine Motel to explore how each institution curates the public history and memory of Civil Rights in relation to the rise of the antiwar and Black Power movements in the late 1960s. With the exception of the National Civil Rights Museum, the museums generally conclude the Civil Rights narrative in the year 1965 with the passage of the Voting Rights Act, which presents civil rights history as a democratic triumph rather than an ongoing struggle for racial justice. Consequently, the museums struggle to internationalize the Civil Rights Movement within the context of the Vietnam War and third world liberation movements that continued after 1965 into the latter half of the decade. With that being said, the National Civil Rights Museum at the Lorraine Motel is the only museum that did in fact internationalize, and chronologically extend, the Civil Rights narrative to include the context of the antiwar and Black Power movements in the late 1960s. Regardless of periodization or depth of international scope, however, each museum successfully challenges its audience to confront the history of racial injustice.

Revisiting Non-Revisiting Random Walks: A Better Way to Explore Networks

Kevin Woytowich
Major: Mathematics

Mentors: Katherine Moore, Mathematics and Statistics and
Kenneth Berenhaut, Mathematics and Statistics

Networks allow us to model interactions between individual entities, whether they are people, companies, computers, or anything else. In a network, points are connected to one another by an edge and are called neighbors. For instance, to model friendships, we could connect people with an edge if they are friends with one another. One way of exploring networks is by using random walks. These are paths through the network that start at a point, move to a randomly selected neighbor, and then continue to move in that fashion.

This summer, we looked at two different types of random walks. Non-revisiting random walks, or NRWs, don't allow the path to stay in the same place, while adding conditions that prevent points from being visited too many times. On the other hand, revisiting NRWs, or rNRWs, use the same general rules of NRWs. But, by sometimes allowing the walk to stay at the same point, rNRWs do a better job of visiting each point equally many times.

rNRWs have been studied recently by Berenhaut and Fan. They demonstrated that rNRWs and NRWs both do a better job of exploring networks than normal random walks. Also, they showed that in trees (a type of network), rNRWs do a better job of evenly distributing visits than NRWs do. This summer, we attempted to generalize this result to all networks. In the process, we also proved a conjecture of Fan's and slightly improved her upper bound for visit differential on trees.

Poster #112

Climate Model Data Compression and Predictability

Siyi (Reyna) Wu

Major: Mathematical Statistics

Mentor: Robert Erhardt, Mathematics and Statistics

Climate models are computer simulations of the earth's climate system. They are produced by major scientific agencies across the globe, including NASA, the National Center for Atmospheric Research, etc. These models are verified and validated against recent climate data, and then projected into the future to explore possible climate consequences of carbon emissions.

In this project, we are interested in the predictability of climate models at the monthly time scale. A model is predictable if the data through time T bears a statistical relationship on the data at times $T+1$, $T+2$, etc. For example, weather models are predictable up to around 14 days, after which there is no discernible relationship. We are primarily interested in predictability at the monthly time scale -- can climate model data be used to make accurate statements about the state climate in the several months ahead? Answers to this question can be used to predict elevated risks of environmental hazards such as heatwaves, droughts, floods, etc.

We first compress high dimensional climate data into low dimensional summaries using empirical orthogonal functions (EOFs), and show we can reconstruct the data closely with a low number of EOFs. We then fit different time series models to the coefficients from the EOFs, and quantify the predictability by comparing predictions to holdout data. We illustrate the method using monthly average global temperature data obtained from NCAR's Community Earth System Model, and demonstrate the computational feasibility of using Vector Autoregressive Models with low numbers of EOFs to quantify predictability.

Poster #113

Yunnan Folk Music

Xiaotong Wu
Major: Music

Mentor: Stewart Carter, Music

In this project, I explored folk music of the minority groups in Yunnan, China. I compared musical elements, such as form, tonality, instrumentation, etc., in the music of four different minority groups. To do this, I visited several cities and villages in Yunnan province, attended local minority festivals, and interviewed local musicians. I visited local museums and attended musical performances. I recorded the music performances and analyzed them afterwards. I went to Kunming, Chuxiong, Lijiang, Lancang, and Xishuangbanna to explore the music and culture of the Yi, Naxi, Lahu, and Dai people. I visited ethnic museums in Kunming, attended Yi and Naxi Torch Festivals in Chuxiong and Lijiang, interviewed cultural inheritors in Kunming, Lijiang, Lancang, and Xishuangbanna. I found out that the life, culture and music of people from the above minority groups are heavily influenced by the Han majority culture, but they have preserved their own style and combined traditional with modern elements while writing new music. It was a great experience because I learned not only the musical aspects, but also the culture and the daily life of the minority groups.

Poster #114**The Structure of Petal Knots**

Grace Yao

Major: Mathematics

Mentor: Jason Parsley, Mathematics and Statistics

A knot, a common object in daily life, is defined mathematically by taking a string and then playing, tangling it and then gluing the two ends of the string together in 3-dimensions. To make a classical knot projection, we look at the shadow of the knot which makes on a 2-dimensional plane; each crossing consists of the intersection of two strands with one as over-strand and the other under-strand. Petal knots, on the other hand, refer to a specific projection of knots, in which there is only one multicrossing with no nesting loops. In a petal projection, all the strands intersect at the single crossing in the projection, resembling the petals of a flower. They can be described with permutations in the symmetric group S_{2k+1} . In this work, we define a new petal diagram movement, called a *slip strand*, on permutations of petal knots and show it necessarily produces an equivalent knot. We describe permutation differences, which indicate the differences modulo n between entries in the permutation, and examine their effect upon knot properties, such as lying on a torus, intrinsic symmetries, etc. A census of all petal knots and relevant properties is also included for $n = 3, 5, 7, 9, 11$ and 13 petals.

Poster #115

The Impact of Xi Jinping's Narrative on Chinese Legal Reform

Kaicheng Yu

Major: Politics and International Affairs

Mentor: Wei-chin Lee, Politics and International Affairs

My project intends to examine the impact of Xi Jinping's narrative on China's legal reform from 2013 to 2019. Xi Jinping rose to power in 2013 and has been reiterating the idea of "the rule of law." As a result of China's opening up to the world and increasing globalization, this idea has been deemed as essential for domestic stability, economic sustainability, international engagement economically and diplomatically for the following years as China continually encounters internal and external changes. Consequently, this project aims to explore how China's coordinated legal reform has reacted to new internal and external changes since Xi has assumed power. This study will identify Xi's direction for reform and examine the Supreme People's Court's role in the implementation of Xi's pledge for "the rule of law." The findings of this project would show to what extent cultural variation, historical experience, and ideological differences can affect the revision of laws. They would also explain the degree to which western legal philosophy, principle, and rules influence China's legal reform. Moreover, the findings could offer lessons to other developing countries' legal reforms to meet the challenge of internal pressure and globalization. In essence, the project tests the validity of John Fairbank's "impact-response" paradigm in explaining China's encounter with the west.

Poster #116

Study of Opioid Overdose in North Carolina with Spatial Regression Model

Guanqi Zeng

Major: Mathematical Statistics

Mentor: Staci Hepler, Mathematics and Statistics

Opioid overdose has been a nationwide problem exacerbated by untracked opioid prescriptions, and a rapidly spreading trend from the northeast states to southwest states in recent years is observed, with North Carolina as the southern frontier since 2010. By looking at the spatial connections, we believed that the opioid overdose death rate of one place is related to its neighboring areas, and that of the previous year. To study the issue of opioid overdose with spatial and temporal concerns, we aimed at building a Spatial Regression model to capture the spreading trend and predict the future death rate. With data collected by the Department of Health and Human Service of North Carolina according to North Carolina's Opioid Action Plan launched by the state government, we obtained records of 17 dimensions, such as death counts, opioid pills dispensed, and ED visits, all at county level, and used data from 2010 to 2017 for its timeliness and completeness. A Poisson Regression model was used for selecting predictors that were statistically significant, then a Bayesian approach was updated, and an Auto-Regressive model was finalized by adding space and time dependences. The predicted death rate of each county from 2010 to 2017 was displayed by maps and compared to the maps with true death rates. The model captured the moving trend of NC opioid death rate from western corner to costal area, and the fluctuating seriousness with year 2013 as the cutting point. More social-economic data can be explored to understand the trend.

Poster #117

A Cross-cultural Study: Eating Disorders amongst College LGBTQ+ Students

Gengrui Zhang

Major: Psychology

Mentor: E.J Masicampo, Psychology

Eating disorders have long been a topic of interest in psychology, as well as the studies of Sociology and Women & Gender Studies. From the dataset of the National Eating Disorder Association, national surveys estimate that 20 million women and 10 million men in America will have an eating disorder at some point in their lives. This abnormality is not occurring only in females, but also in males and the LGBTQ+ community. According to the studies of Carlat and Feldman, it is estimated that 10% to 15% of persons meeting the diagnostic criteria for an eating disorder is male, of which 20% identify as gay. Another research result shows that males might be less likely to seek treatment because they are less likely to recognize their eating disorders because they do not match the stereotype of eating disorders being a female problem (Grillot 2018). Overall, eating disorders do happen and matter to men and LGBTQ+ groups. My research question is the relationship between eating disorders and college LGBTQ+ groups. Since my research will involve a lot of variables, I have different groups of hypotheses. Students who identify themselves as LGBTQ+ groups in the U.S will have a significantly lower probability of suffering from eating disorders than those in China. In the Chinese participants, college LGBTQ+ students will be significantly more probable to get eating disorders than straight people.

Poster #118

Prediction of Working Memory Using Networks Combining Resting and Task State Functional Connectivity Data

Jiya Zhang

Major: Psychology

Mentor: Dale Dagenbach, Psychology

Previous research has shown that human brain functional connectivity—correlated activity between different brain areas—can be used to predict cognitive measures such as episodic memory, attention, and fluid intelligence. Most of these studies used resting state brain data. However, a similar attempt to predict working memory using resting state data failed. The current study combined resting and task state data to test whether it would enhance prediction. Data were obtained from the Human Connectome Project using a sequence during which participants alternated between rest and various working memory tasks. For each of the randomly selected 30 participants, we correlated brain activity (measured by BOLD signal) among 268 regions. Then, we correlated these correlations with behavioral measures of working memory and identified 130 positive edges and 80 negative edges that might be important for working memory. “Positive edges” were links between two nodes whose correlation was significantly positively correlated with working memory. “Negative edges” were links with significant negative correlations with working memory. After running a regression analysis using positive and negative edges, we were able to use correlations from these edges to predict working memory. To test our results, we masked the same groups of positive and negative edges onto data from a different sample and were able to predict working memory again. The results of our study illustrated that if brain activity changes happen in close proximity, combining resting and task state data has the potential to predict cognitive abilities.

Poster #119

Assembly Instructions, Classifiers, and HPC

Yixin Zhang

Major: Computer Science

Mentors: Samuel Cho, Computer Science and Physics and
Errin Fulp, Computer Science

Being able to configure an application on a device is important because a proper configuration would allow the application to make efficient use of the available hardware resources. In Anarv's Master Thesis and Katherine's honor Thesis, some explorative work was done on extracting the x86-64 code executed while an application is running. And together with Dr. Errin Fulp, they developed a profiling system that captures the run-time information that allows the involvement of machine learning algorithms. My research is the continuing work on how the dynamically extracted assembly code profile could be used to predict what does this application aims in doing, or which hardware resources should be allocated to it so that it can be executed more efficiently.

In this project, several computationally intensive computer-based experiments were conducted, all happened on the HPC DEAC Cluster. Several TB of source data was eventually converted into profile data size less than 1 GB. An extensive study on the performance of different classifiers, specifically, SVM and Random Forest with different parameters were evaluated. We end up with some factual evidence to deny the guess made in the previous work and support the new claim we modified. Also, the working flow of this experiment is also modified so that the experiment can take advantage of the exponentially higher computation power provided by the DEAC Cluster.

Poster #120

Zoning and Residential Sales in Winston-Salem

Yuzi Zhang

Major: Economics

Mentors: Tin Cheuk Leung, Economics and Megan Regan,
Economics

Zoning has been a method used by local authorities to plan and develop urban communities across the nation since its first implementation in Los Angeles. Based on the residential sale data and zoning files in Winston-Salem covering a time frame of 18 years, this study shows that zoning classifications as well as zoning changes in either selected census tracts or on city level have a statistically insignificant impact on sale prices. This conclusion may suggest that the current zoning regulations and status within Winston-Salem, though coordinating urban development, has a limited role in affecting the sale price of the housing market. This result may also be indicative that policymakers may not use zoning as a tool for price control of the housing market.

Poster #121

Implantable LED for reducing thrombosis

Jacqueline Zhu

Major: Biophysics

Mentor: Daniel Kim-Shapiro, Physics

Past research has found synergistic effect of nitrite and red light (660 nm) resulted in longer lag time than nitrite treatment alone. It was understood that red light illumination enhanced nitrite bioactivation by red blood cells (RBCs). One potential issue of the red light is that it has limited tissue penetration depth. Since the potential therapeutic effect of nitrite and red light in treating thrombotic diseases was proposed previously, the purpose of this research was to investigate the possible applications of nitrite and red light treatment in real medical situations and thus an implantable light emitting diode (LED) was constructed as the light source for carrying out future in vivo experiments. The intensity of red light decreased by 90% after penetrating 1.5 cm of muscle tissue, while an implantable LED could be directly placed at the target area without intensity loss. A wireless, biocompatible, and implantable LED was successfully constructed, tested to be functional in an aqueous environment, and was able to emit light at 660 nm up to a distance 5 cm above the transmitter coil. Then, the effect of the implantable LED was compared to a previously used exterior (non-implantable) "deep red" LED (M660L4, Thorlabs, NJ) on reducing blood clots (Wajih 2019). Based on current results, the implantable LED had similar behavior compared well to the regular LED, but more replicates are needed to test its statistical significance. In spite of that, the application of the implantable LED was promising due to its mobility and flexibility.

Poster #122

Historical Organs in Germany and Sweden

Julianne Zhu

Major: Music Performance

Mentor: Stewart Carter, Music

When we talk about Baroque music today, we refer to it as an exquisite art. However, the term “baroque”, derived from the Portuguese barroco, means a misshapen pearl. One “misshapen” aspect of Baroque music is characterized by temperaments, i.e., tuning systems. During the Baroque era, instruments were tuned to unequal temperaments, such as quarter-comma meantone, Werckmeister, and Neidhardt. They set certain limits on the music because some keys are better in tune while others are virtually unusable, and therefore influence how composers conceive their music. By the same token, the music also demanded a particular type of instrument in return. The pipe organ, being the “king of instruments”, and being the most difficult to tune, clearly reflects this trend. It also has a unique feature: specification, which is the entire set of stops and, just like temperaments, tends to differ accordingly to era and region. This project studies the tunings, specifications, and construction history of 27 organs in Germany and Sweden. German and Swedish organ-building traditions were closely related as Swedish culture was largely influenced by Germany. Almost all of these organs have undergone restorations and renovations, and thus their temperaments and specifications today may not necessarily reflect the taste of their time. Further research, however, revealed how these instruments have evolved over time.

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