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Hope College Abstracts: 16th Annual Celebration of Undergraduate Research and Creative Performance

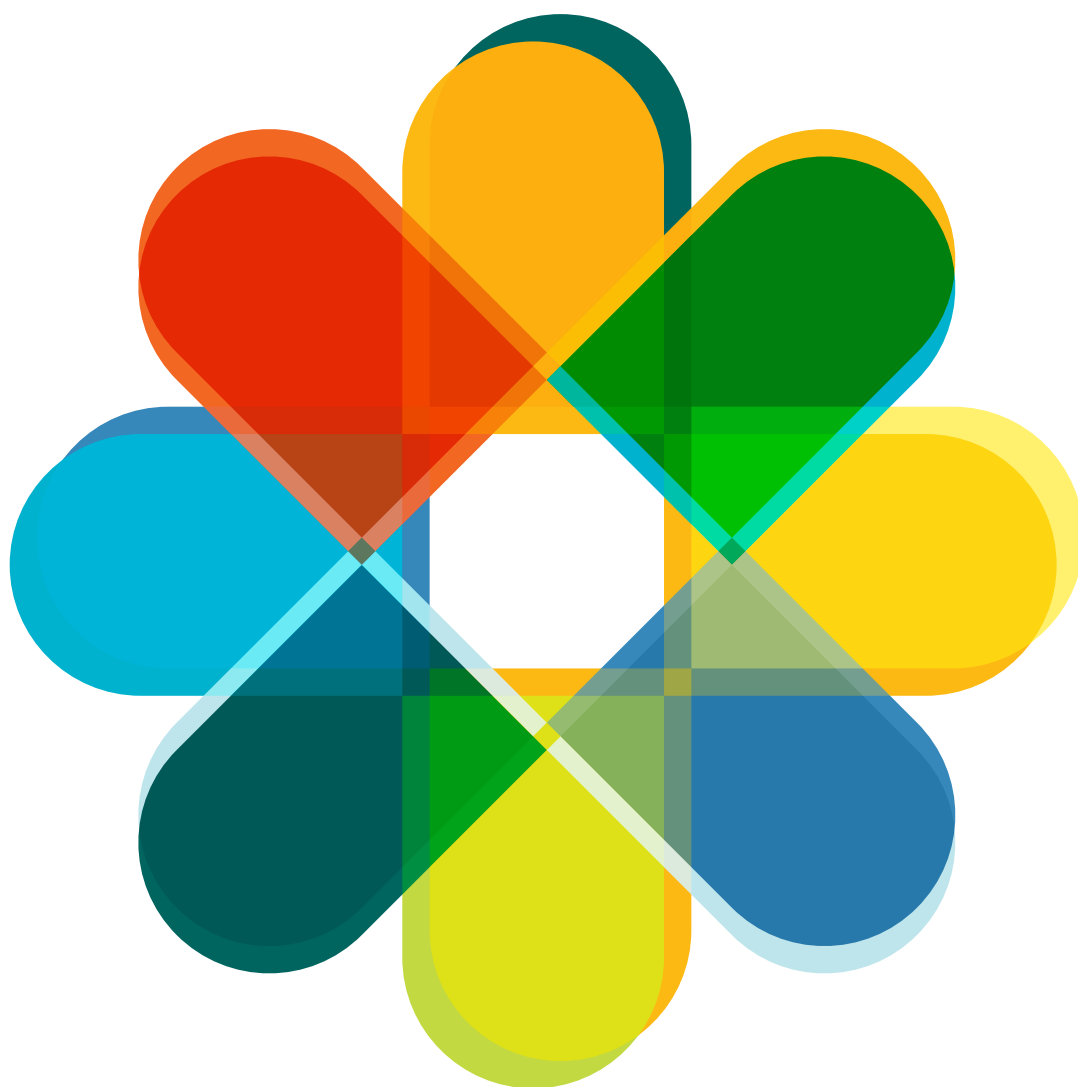
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16TH ANNUAL
CELEBRATION OF
UNDERGRADUATE RESEARCH
AND CREATIVE PERFORMANCE

2016-2017
ABSTRACTS

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April 21, 2017

Dear Friends,

We are pleased to welcome students, guests, and community members to the 16th annual Celebration of Undergraduate Research and Creative Performance at Hope College. This event highlights scholarly accomplishments by talented Hope students working collaboratively with exceptional faculty mentors.

Hope College is nationally recognized for the extent and quality of its undergraduate research program. This year's Celebration includes 226 presentations by 358 students from 28 different departments and programs. Research occurs both during the academic year and summer, spans the four academic divisions, and includes independent study and course-based research. The Phelps Scholars and Day 1 programs engage students in learning communities, and the Mellon Scholars program supports cross-disciplinary and global research. Hope students regularly receive national recognition for their research accomplishments with NSF Graduate Research Fellowships, Fulbright Scholarships, Goldwater Scholarships, and professional society awards.

The *Hope for the World: 2025* strategic plan states that "Every student's academic program will include rigorous, relevant, customized, faculty-supervised experiences (on or off campus) that link intellectual skills and habits developed through the liberal arts with vocational aspirations." Through varied research opportunities across campus, students learn more deeply, find meaningful connections between their education and future plans, and develop creativity and skills to succeed in college and beyond.

Each abstract in this book describes original and creative scholarship arising from research that Hope students and faculty have pursued together. Beyond the development of new knowledge, these projects are among the most transformative learning experiences in a student's academic career. The interaction with caring and dedicated faculty mentors results in expanded awareness and opportunities for student post-graduate plans and career aspirations.

Thank you for your participation in and support of this Celebration. To learn more about research experiences at Hope College, visit the website: hope.edu/research.

Sincerely,

A handwritten signature in black ink that reads "William F. Polik". The signature is written in a cursive, slightly slanted style.

William F. Polik
Associate Dean for Research and Scholarship

Honoring an Inmate through Socially Engaged Art

Katheryn Irwin
Leah Krudy
Julia Kirby
Darwin Guillen
Emily Branca
Grace Hulderman

Mentors:

Professor Tori Pelz,
Art and Art History

Professor Sara Alsum-
 Wassenaar,
Art and Art History

Deb Coyle,
CASA Program Coordinator

Socially engaged art is frequently used as a vessel of change. An artist can bring together his/her vision and a community of people together in order to collaborate on art aimed at making a social impact. Collaborations such as these can produce bold messages that foster change in society. Specifically, the fight for social justice has been greatly supported by socially engaged art. In a recent first year seminar (FYS) project, students collaborated to prepare and host a dinner party on behalf of a local inmate and his family. The gathering explored concepts of honoring and remembering loved ones, as well as accepting and forgiving them. In order to frame the event as socially engaged art, the dinner incorporated student-designed visual elements, such as placemats with stories of transformation by other inmates as well as decor highlighting Gregory's poetry. Gregory's reflections of his own journey were also included in a book that was presented to the family at the dinner. In the book designed by students, *Walking Gregory's Neighborhood*, Gregory takes Professor Pelz on a tour of his neighborhood through poetic descriptions of formative sites. A second FYS class prepared the food for the dinner party and thoughtfully considered hospitality arrangements for the evening, enacting Gregory's wishes in every detail for the event. This class focused on extending hospitality and utilizing food and connection to bring comfort. Preparation for the project consisted of learning about prejudices and discrimination that inmates and former inmates face, the disparity in incarceration rates between different races, and the effects of mass incarceration. Through this project, students directly observed the positive impacts that socially engaged art can have on a group of people.



**Paralyzed Traditions:
European Influence
on Global Dance**

Katie McMorris

Mentor:

Professor Linda Graham,
Dance

Although separated by cultural differences, language barriers, and geographic divides, many global dances share similarities in their purpose, style, and movement. Through a cross-examination of different cultural and global dances, one can recognize the innate human similarities that exist within dance as an art form. However, beyond these similarities, one more aspect remains the same among these dances from all over the world: through European influence, many global dances were degraded and therefore disassociated from their revered origins. As Europeans colonized places such as Hawaii, India, and Brazil, they viewed the traditional dances with disdain and fostered a continuous misperception about the greater culture in which these dances resided. Ultimately, many global dances today, while retaining some of their source value, have morphed and adapted due to European intervention, and they will never return to what they once were. This research aims to provide a comparison of global dances and the different ways in which European pressure influenced these cultural traditions.

**The Man Who Wore
Red: Allen Stringfellow**

This project was an interdisciplinary endeavor done with the Department of Dance and made possible through the Mellon Scholars Program. See page 24 in the Mellon Scholars section of this book for full abstract.



Disability in Literature: A Girardian Perspective

Robert Lampen

Mentor:

Dr. Curtis Gruenler,
English

*This work was supported by
the Jacob E. Nyenhuis Grant
for student and faculty
collaborative research.*

This project embodies the culmination of the 2016 summer research I conducted at Hope College regarding the intersection of Disabilities Studies, Mimetic Theory, and Young Adult Fiction. This research utilizes a corpus of five recent novels: Mark Haddon's *The Curious Incident of the Dog in the Night-Time* (2003), Francisco X. Stork's *Marcelo and the Real World* (2009), Jennifer Roy's *Mindblind* (2010), Vicky Martin's *M is for Autism* (2015), and Aaron Cully Drake's *Do you think this is strange?* (2015). Each work includes a narrator on the autism spectrum, has achieved success in the public sphere over the last 15 years, and falls under the umbrella of Young Adult or crossover fiction. My research uses these examples to assert that the increase of first-person narrators with intellectual disabilities has functioned to give a voice to this marginalized population. By applying Mimetic Theory, one better understands the inner-workings of the scapegoating and bullying that people with disabilities face. The mimetic concept of identifying with the victim then opens up a dialogue about the social constructions, medical symptoms, and misconceptions that work together to disable individuals with intellectual disabilities. Finally, the research's study of conscious and unconscious forms of mimesis help readers better understand the cognitive function of both neurotypical and non-neurotypical individuals. Overall, this research seeks to prove that applying a Mimetic Theory lens to this popular form of YA literature provides the beginning solutions to forms of persecution by explaining how literature functions as a guide to support marginalized people through advocacy and understanding.

The Modern History of Global Food

Margaret Dickinson
Noah Switalski
Leland Cook
Natalie Fulk

Mentor:

Dr. Lauren Janes,
History

This research was supported by the Pagenkopf History Research Fund.

Can we trace the long history of globalization through the movement of foods around the world? History students Leland Cook, Margaret Dickinson, Natalie Fulk, and Noah Switalski will share their insights from collaborative research with Dr. Lauren Janes during the summer of 2016. Each global food—potatoes, sugar, curry, and rice—tells a story of connectivity across continents and cultures, showing how our lives, diets, and economies were shaped by centuries of meaningful interactions around food.

Beauty, Wit, and Friendship: The Recipe for Female Influence in Seventeenth Century France

Katelyn Kiner

Mentor:

Dr. Janis Gibbs,
History

The life and reign of Louis XIV is a thoroughly studied period of history. However, it was not until the about 1970s that the lives and contributions of elite women in Louis XIV's France began to be studied in greater depth. Many women of the court and Parisian nobility left behind diaries, collections of letters, or novels that detailed their lives. At a glance these accounts do not seem to tell more than the mundane goings-on. However on a closer look they recount the struggles of these elite women to influence the highly patriarchal society. Women's contributions were ignored because they functioned outside of the official government power structure. Instead they held a more informal, but nonetheless formidable power as wives, mistresses, or family of powerful men. The research studies the accounts left behind by six women, three from Parisian high society—Madame de Sévigné, Ninon Lenclos, and Mademoiselle de Scudéry—and three from the court of Louis XIV—Madame de Maintenon, Madame de Montespan, and Madame duchess of Orléans. These six women's perspectives uncover the three common ways highly placed women achieved influence and power in Louis XIV's court.

History behind the Hashtag: The Historical Roots of the Black Lives Matter Movement

Allison Utting
Alissa Frazee
Briana Bailey
Mariah Bensley

Mentor:

Dr. Jeanne Petit,
History

It began as a hashtag. Generated by the acquittal of George Zimmerman in the killing of Trayvon Martin in July of 2013, the Black Lives Matter movement emerged as an online response to claims of police brutality and racial discrimination. By August, 2014, the movement had transferred from the screen to the streets as demonstrators filled Ferguson, Missouri to protest the killing of Michael Brown. Subsequent reports of racial profiling and police killings only added fuel to the movement's fire and its message quickly captured national attention. The apparent spontaneity in which the Black Lives Matter movement developed is belied, however, by the long history of racial injustice in the United States and the protest movements that have sought to respond to oppression. In an effort to understand this centuries-old story, this team examined the historical roots of the Black Lives Matter movement in the areas of politics and law, culture, organized responses, and violence. Specifically, this project sought to explore the Black Lives Matter movement within the context of the Brown v. Board court decision, the media, the women's sit-in movement, and the 1967 Buffalo riots.

Shaping Urban Modernity in Shanghai and Paris through the Building of Roads and Parks

Joseph Williams

Mentor:

Dr. Gloria Tseng,
History

In this paper, I argue that urban modernity is characterized by functional utility and aesthetic elements. Nineteenth-century Paris and early twentieth-century Shanghai provide strong evidence for this argument, because both cities underwent large-scale building projects in the form of roads and parks. What is striking about these two cases is that two distinct forces, the imperial government in Paris and private enterprise in Shanghai, created cities that were symbols of modernity and cosmopolitan values in the nineteenth and twentieth centuries, respectively. This research examines the impact of the road and park building projects of the Shanghai International Settlement on Shanghai's urban modernity. By juxtaposing the International Settlement's road and park building projects with Paris's urban renewal under Napoleon III's Second Empire, the effects of road and park building projects on urban modernity becomes evident. The Report of the Hon. Mr. Justice Feetham to the Shanghai Municipal Council (1931), a consultative report for the Shanghai Municipal Council authored by the South African Judge Richard Feetham, is used as the main primary source for this research on Shanghai, and its contents provide valuable insights into the intricacies of the International Settlement.

Perception in a Second Language

Aleksandra Masiak

Mentor:

Dr. Daniel Woolsey,
Modern and Classical Languages

Any person who has attempted to learn a second language knows it brings certain difficulties. Although progress can be made with time and practice, even some of the most advanced second language speakers encounter difficulties with replicating the sound production and the accent of native speakers. The realms of speech production and speech perception are closely related. The importance of speech perception in a second language can be expressed in this way: in certain cases, until a second language learner can correctly perceive sounds, they cannot consistently produce those sounds. There are many factors that affect the perception, or the lack of perception, in a second language; these include personal factors, factors of the native language or the new language, and time spent in the language.

Architecture and Education in India

Taylor Mills

Mentor:

Dr. Maria Claudia Andre,
Modern and Classical Languages

This work was supported by the Jacob E. Nyenhuis Grant for student and faculty collaborative research.

Literary giant Rabindranath Tagore shaped both his homeland of India and the world with his poetry, art, music, and philosophy during his lifetime of 1861-1941. His legacy continues to influence modern society as young writers observe his words, philosophers observe his life, and Indians observe his face on street corners and hear his music in their ears. Perhaps his greatest contribution, however, is carved into walls and plaster, eventually etching themselves into the minds of students. Tagore had deep convictions about the marriage between nature and education; these convictions took root in the foundation of his school in Santiniketan. Because nature was essential for introspection, understanding, and learning, Tagore developed concrete notions of how architecture should lend itself to nature, and therefore to education. This summer I was funded to visit Jorasanko in Calcutta, FLAME University in Pune, and Shantiniketan in West Bengal, India, with Professor Maria Claudia Andre. Here I encountered Tagore's philosophies carved into the buildings that surrounded his life. Drawing from my experiences in India, as well as investigating Tagore's philosophies of education, space, and nature through works like Samit Das's *Architecture of Santiniketan*, my research explores Tagore's ideas of architecture for education, as well as his influences on modern institutions in India today, pursuing an answer to the question: how does physical space influence learning?

Emotional Expression through Linguistics

Katherine Pittman

Mentor:

Dr. Daniel Woolsey,
Modern and Classical Languages

There exists a definite connection between the linguistic and psychological worlds. Although the categories of language prove certain limitations, we find ways to express our infinite variety of emotional experiences through these limits. We desire to express ourselves emotionally because ultimately we desire to be known beings. To put our emotions into words, however, is a great and difficult task, but we find a way to express ourselves through language, verbal and nonverbal, to reveal parts of our psyche, as we try to describe and share our emotional experiences. In the present paper I explore and explain why language is important to emotional expression starting in infancy, how it reveals the internal state of an individual, and what all of this implies for individuals who identify as bilingual.

Flourishing and the
Unity of Virtues:
Psychology Listens
to Philosophy

This project was an interdisciplinary endeavor between the Department of Philosophy and the Department of Psychology. See page 118 in the psychology section of this book for full abstract.

Self-regulation
as an Underpinning
Mechanism of Virtue

This project was an interdisciplinary endeavor between the Department of Philosophy and the Department of Psychology. See page 122 in the psychology section of this book for full abstract.



Understanding Noah's Flood

Andrew Bennett

Mentor:

Dr. Barry Bandstra,
Religion

Noah's Flood was one of the first stories we learned as children. From being the subject of hundreds of Western art pieces to a recent Russell Crowe movie, it has been one of the most popular stories throughout the ages. But, what does it mean? When we look closely at the text, we find Noah's flood story is a composite of two different flood stories: One from the Jahwist source document and the other from the Priestly. Using the best of modern scholarship to place the stories within their original context, we can understand what they meant to their original audience. My research shows that the Jahwist flood story was both a theological statement about the Israelite God and a familiar story to help the Israelites understand their origins and place in the world. On the other hand, we found the Priestly flood story was a proxy for the diasporatic Israelite people. They saw themselves in the text. They identified with Noah's struggles and hoped God would remember them too and restore them into a new Israel. Without realizing what these documents each meant in their own contexts to their intended audience, we could never hope to truly understand Noah's flood. And once we do, this ancient story reaches through the millennia and reveals a facet of truth about ourselves, our world, and our God that we would have otherwise missed.



Love and Information Lighting Design

Nils Fritjofson

Mentor:

Ken Chamberlain,
Theatre

Love and Information by Caryl Churchill departs from traditional play structure by presenting fifty contentless scenes in which the setting, mood, and characters are left open ended. The production concept required a lighting design that was simplistic in nature, but allowed for the creation of a unique look for each scene. This project covers the process of creating the lighting design for Hope College's production of this work, starting with conceptual production meetings and concluding with the realized production. The process will be shown through conceptual research images, preliminary paperwork used to flush out the design, and a drafting of the light plot used by the electricians to place the lighting instruments required. Final support paperwork will include a channel hookup and instrument schedule, listings of all the lighting instruments used; the magic sheet, a resource used by the designer to quickly locate and adjust channel levels; and the final cue list. Archival production pictures will be included to show the realization of the design.

Love and Information: Stage Management

Nathan Gingrich

Mentor:

Reagan Chesnut,
Theatre

The project will show the process of stage managing *Love and Information* from start to finish, and the effort required to stage manage a full production. Stage management is the organization and coordination of actors, production staff, set, light, sound, and costume designers, crew members, and additional production crew, the end result being the creation of a fully-fledged theatre production. This process involves running production meetings, recording notes in rehearsals for the designers, recording blocking notes to track actor movements, marking the location of cues for sounds or lights, and then running the show once it opens. This is referred to as "calling" the show, which involves giving cues for the light and sound board operators, as well as for backstage crew and a projector operator. The notes taken over the course of the production, as well as the script with the list of cues, are held in a large prompt book which represent the culmination of the stage manager's work.

Jane Eyre: The Musical

**Aaron McEachran
Gracen Barth
Anna Jones**

Mentor:

Reagan Chesnut,
Theatre

Hope College Theatre Department's production of "Jane Eyre: The Musical" presented an array of unique challenges. Research for this production started with a general analysis of the script for technical elements. This analysis included a thorough evaluation of the settings, props, costumes, lighting, sound, and other unique challenges called for in the original script. This analysis was conducted with the understanding that many of those elements called for could be removed, minimized, or changed throughout the rehearsal process. After this initial analysis was conducted further analyses were performed during production meetings and throughout the rehearsal process. To gain a complete understanding of our production, all the pieces involved, and how they all work together, close attention was payed to the requests and comments of the director and designers. These requests and comments were recorded in production meeting and rehearsal reports throughout the process. Along with this a detailed record of the movements of actors, props, and set pieces was kept throughout the process. All this information was eventually compiled and used to formulate a record of the production both on and offstage assisting in a smooth and consistent run during each performance.

Analyzing Library Marketing and Communication Efforts at Liberal Arts Colleges

Laurel Post

Mentor:

Jessica Hronchek, MLS,
Library Sciences

Academic libraries are constantly changing in response to advances in technology. One facet of this is how libraries are promoting and marketing themselves to patrons. Social media has become a tool many businesses use to promote themselves, and libraries have started to use it to connect with patrons and educate them on resources. There is currently a limited amount of literature on how smaller academic libraries are approaching social media as well as how they are generally marketing themselves to the campus community. We conducted a study to determine how other small liberal arts college libraries are using social media and other promotional materials for outreach, communication, and marketing as well as the staff involved in this process. We surveyed participants (N=33) and asked them questions regarding their usage with social media, newsletters, and marketing material for promoting their library. Our data was then used to assist Hope College Libraries in their marketing efforts.



The Anti-Slavery Almanac

Kirstin Anderson
Nina Kay
Andrew Monroe

Mentors:

Dr. Anne Heath,
Art History

Laura McGrath,
Mellon Scholars Program

*This project was supported
by the Andrew W. Mellon
Scholars Program.*

The Anti-Slavery Almanac collection is owned by the New York Public Library and visible via their digital commons. This collection of almanacs was published between 1836-1844, and contains a multitude of anecdotes meant to appeal to those in the country who wanted to abolish slavery. In analyzing the collection using digital text analysis tools, our group found that three subjects stood out. These include appeal to religion/morality, sectionalism, and the profound impact women had on the anti-slavery movement. Our research explores each of these topics using The Anti-Slavery Almanac and other supplementary sources. By examining each of these three topics, we hope to provide insight into the humanity behind the abolitionist movement, and illuminate the complexity of a deeply compelling and at times divisive ideology that has shaped the face of America since the early 1800's.

St. Philip's Sons: Frederick William Faber and His Hymnody

Jonathan Bading

Mentor:

Dr. Huw Lewis,
Music

*This project was supported
by the Andrew W. Mellon
Scholars Program.*

Though historians have often used poetry and prose as means of gauging the cultural and aesthetic values of a people, hymnody measures how an individual and/or society publically relate to the divine, a uniquely insightful attribute. The hymnody of Frederick William Faber (1814-1863), a disciple of John Henry Cardinal Newman who similarly left the Church of England for Roman Catholicism, speaks to the convert-priest's enchantment with the Catholic faith, while also shedding light on some of the theological tensions ever-present in a religiously tumultuous Victorian England. Faber wrote over 150 hymns in his short life, a canon spanning the time between his conversion and his death at the age of 49. Though his hymnody covers many subjects, Faber addressed a significant amount of his hymns to St. Philip Neri, the Counter-Reformation Italian priest who founded the Oratorians, the order to which both Fr. Faber and Cardinal Newman ascribed. Faber centers his 1852 collection, *Jesus and Mary*, around eight St. Philip hymns, particularly focusing on St. Philip and his role in English Catholicism.

After analyzing selections from these eight hymns and researching both the lives of Faber, Newman, and St. Philip, I discovered that these men shared a common vision for the Catholic Church's aesthetic role in a Protestant context; these three men proclaimed beauty as the greatest witness to the truth of the ancient faith. This type of research blurs the lines between both religious and music history as well as anthropology.

Looking Up: Discovering the Characters, Chronology, and Complexities of Baroque Italian Ceiling Art

Ellee Banaszak

Mentor:

Dr. Anne Heath,
Art History

*This project was supported
by the Andrew W. Mellon
Scholars Program.*

Italian Baroque paintings and their iconography are fascinating topics studied by art historians and art lovers alike. While there have been many resources published about Italian fresco and panel paintings and their iconography, this information is not as readily available to students and the public as one might expect. This is due in part to the sheer volume of paintings, as well as the fact that much of this information is only available in specialized bibliography. My research brings this information together into an easy to use digital format thereby providing a publically accessible teaching tool for undergraduate students and the general public. For a research fellowship in the summer of 2016, I chose four ceiling paintings from prominent buildings in Rome, Italy; namely, the Palazzo Barberini, the Palazzo Farnese, and the church Santa Maria Maggiore in order to create iconographic maps using the platform Neatline. The paintings chosen were Divine Providence by Pietro da Cortona, Divine Wisdom by Andrea Sacchi, The Loves of the Gods by Annibale Carracci, and the Baptistry painting in Santa Maria Maggiore, artist unknown. I conducted fieldwork in Rome photographing the frescos and giving greater physical context to the paintings and observing lesser-known details. I also assembled the iconography from a variety of dispersed sources, paying particular attention to the lesser-known and often unpublished symbolism of minute features in the paintings, especially non-iconic details. Using DSLR photography, Omeka hosting, and Neatline, I created digital interactive maps of these ceilings that allows the viewer to hover over different parts of each ceiling and learn the different characters, motifs, and other interesting features, while also providing additional information on the buildings and artists in a traditional website format. The resulting maps provide scholarly knowledge in a digestible format that is simple to use and engaging for non-specialists.

Little Modern Magazines

**Katrin Kelley
Annika Gidley
Rachel Brumagin
Joshua Chun Wah Kam**

Mentors:

Dr. Curtis Gruenler,
English

Laura McGrath,
Mellon Scholars Program

*This project was supported
by the Andrew W. Mellon
Scholars Program.*

This project analyzes the role of 20th-century modernist literary journals in perpetuating and promoting social and political movements. The literary journals of this period were significant because they facilitated relevant and provocative conversations in the post-Victorian world, agitating for social movements prevalent in the modernist era. The journals used for this project, most notably the *Little Review*, *Crisis*, and the *New Freewoman*, are drawn from The Modernist Journals Project, a joint effort of Brown University and The University of Tulsa. The digitized database of literary journals, collected from 1890-1922, includes publications from Chicago, London, and Toronto. All publications were originally printed in English and facilitated a free flow of ideas and controversy across the Atlantic. Our research analyzes the relationships and appearances of major voices of the day, including W.E.B DuBois and Margaret C. Anderson. The volume of their writings and the journals they gravitated to make up the bulk of our study, alongside close text analysis. These literary journals ultimately opened up a major platform for voices excluded from mainstream society, including the Suffragette and Civil Rights movements. Most vitally, these magazines created a nexus for polemic writers, thinkers, and audiences to unite against conservative mores.

The Performance of Womanhood

Carolyn Ellis

Mentor:

Steve Nelson,
Art

*Andrew W. Mellon
Scholars Program*

*This project was supported
by the Andrew W. Mellon
Scholars Program.*

Womanhood is universal, yet uniquely expressed by each individual. Feminist movements span across history as woman continually explore what it means to be a woman both past and present day. Art has become a medium of expressing the experience that is womanhood, especially that of female photographers. Inspired by the medium of performance photography featured in the Winter 2015 Aperture 211 magazine, the research became centered around the performance that is womanhood. Performance photography began with Hippolyte Bayard's *Le Noyé* (Self-portrait as a drowned man) in 1840 and has long inspired artists to perform both in front of the camera and behind it. Performance photography explores the intentional and unintentional blurring of the line between photography of the performance and performative photography. Womanhood is explored by researching such performative artists such as Helena Almeida who draws and paints both in and on her photographs. A portfolio of photographs were created based off of the research and were digitized into a website that explores how womanhood becomes its own entity and transforms what is a performance itself; in all of its rituals, details, irony, and juxtapositions.

Digital Holland

**Elizabeth Ensink
Kirstin Anderson
Irene Gerrish
Sarah Lundy**

Mentor:

Laura McGrath,
Mellon Scholars Program

*This project was supported
by the Andrew W. Mellon
Scholars Program.*

Founded in 2014, Digital Holland is a publicly accessible website that hosts research about the communities that include and surround Hope College. The website, digitalholland.org, was developed by students in the college's Mellon Scholars Program, a three-year curriculum of digitally-enabled collaborative research and experiential education funded by the Andrew W. Mellon Foundation. The website features engaging galleries and pages covering a wide variety of topics, highlighting the diversity and historical importance of the Holland community. The site also hosts relevant artifacts including images, audio, and video files shared with permission by the Joint Archives of Holland and the Holland Museum. The project continues to grow as Hope College students, Mellon Scholars, and community members contribute to the site. In the 2016-2017 academic year, Digital Holland underwent both an aesthetic and conceptual shift, redefining our audience and user experience. The new Digital Holland actively promotes community engagement through local partnerships, a joint venture in digital public history. In addition, the site features research projects completed by Hope College students from a variety of disciplines, providing a platform to disseminate exemplary scholarship. Our poster highlights both the process and product of the Digital Holland redesign: our work product as a team and the engaging, community-oriented repository of research. We will feature examples of student research exhibits as well as crowd-sourced articles. Digital Holland can serve as an example for other communities and institutions committed to partnering on digital public scholarship.

Same Sex Marriage in the United States

Anna Jones

Mentor:

Dr. Jack Mulder,
Philosophy

*Andrew W. Mellon
Scholars Program*

*This project was supported
by the Andrew W. Mellon
Scholars Program.*

One of the currently contested issues in our society is that of the legality of same-sex marriage in the United States. The goal of my project was to objectively consider the arguments put forth on the either side of the debate by both the media and academic scholars. In so doing, I desired (1) to pinpoint faulty reasoning in popular arguments found on opposing sides of the issue of same sex marriage, and (2) to present cogent arguments for both stances in a way accessible to the general population. In order to accomplish this accessibility I chose the format of dissemination for my research to be that of a Prezi presentation. I believe that this format is one that can be accessible for all people while still retaining a high level intriguing academic thought. My hope is that with my research, people will have an increased capability to think critically about the issue of the legality of same sex marriage in our country and thoughtfully formulate their own positions while respecting those of others.

Secret Desire: Islam, Mysticism, and Peace-Making in Hikayat Hang Tuah

Joshua Chun Wah Kam

Mentors:

Dr. Curtis Gruenler,
English

*Andrew W. Mellon
Scholars Program*

*This project was supported
by the Andrew W. Mellon
Scholars Program.*

This paper analyzes the peace-making role of Islam in Hikayat Hang Tuah, a 17th-century Malay epic, and its implications for the imagined glorious past in modern Malaysian politics. Hang Tuah, the legendary protagonist, remains a fiercely loved but hotly contested national hero, claimed by various ethno-religious factions in present-day Malaysia. My argument hopes to establish that Muslim piety in HHT is portrayed as a resource for resolving interpersonal conflict, reimagining the honor-based rivalry depicted in its earlier chapters. As Salleh comments in the introduction of his translation, the second part of HHT enters a “sober... mature phase” (XXI), painting scenes of reconciliation between brothers, foreign kingdoms, and between humans and Allah. Hang Tuah’s personal mysticism too reflects the role of faith as a conduit of cross-cultural camaraderie. Islam in HHT connects the Malay world to its neighbors and to the divine, just as the classical Malay author sought to connect the audience through literature to divine insight. Drawing on Braginsky and Errington’s scholarship, my paper adopts the traditional reading of the Malay hikayat, in which the audience received literature as both a mirror of contemporary events, and as a guide to navigate human society. My paper hopes to establish that HHT’s depiction of peace, Malay identity, and Islam runs in antithesis to its factional conscriptions in modern politics. Ultimately, it encourages a reevaluation of Hang Tuah not as a symbol of polemics but of peace, and of the latent inclusivity woven into the nation’s literary fabric.

Roustabout: The Great Circus Train Wreck! Dramaturgy

Rachel Kennedy

Mentor:

Michelle Bombe,
Theatre

*This project was supported
by the Andrew W. Mellon
Scholars Program.*

In the early 20th Century, circuses were one of the central sources of entertainment in Midwestern America. One of the most prominent circuses was the Hagenbeck-Wallace circus, known for their talented clowns and exciting animal acts. However, early in the morning of June 22, 1918, disaster struck as an empty military train crashed into the Hagenbeck-Wallace train as they passed through Hammond, Indiana. This crash left eighty-six of the circus members dead and another 127 injured. Due to poor record keeping in the circus, the vast majority of the deceased were left unnamed. Roustabout: The Great Circus Train Wreck! is a play that brings to light the story of the Hagenbeck-Wallace train wreck that occurred in 1918 by giving life to performers that could have perished in the crash. As dramaturge for Hope College's production of Roustabout, I explored how the circus culture in the 20th century influenced the Hagenbeck-Wallace train wreck and its aftermath. I looked at the performers, the animals, the advertisements, and the Hagenbeck-Wallace circus itself to find answers.

The Founding Fathers and the New York Society Library

**Sarah Lundy
Olivia Lehnertz
Irene Gerrish
Kelly Arnold**

Mentors:

Dr. Curtis Gruenler,
English

Dr. Anne Heath,
Art History

Laura McGrath,
Mellon Scholars Program

*Andrew W. Mellon
Scholars Program*

*This project was supported
by the Andrew W. Mellon
Scholars Program.*

The Founding Fathers have long been considered in the public imagination as the creators of the modern democratic system. Like their educated, political-minded European contemporaries, these men supplemented their formal education with outside reading borrowed from libraries such as the New York Society Library, the oldest library in New York City (founded in 1754). Thousands of entries in its ledgers dating to the eighteenth-century track the lending histories of books read before, during, and after the American Revolution. Through examination of these recently digitized ledger pages available at the New York Society Library from 1789 to 1805, the books that these Founding Fathers chose to read shed light on who these men were, both politically and personally, in relation to the world around them. By visualizing data and analyzing the relationships present between these men and literature that they read, this project explores how the Founding Fathers were influenced by their continual education and presents the results on a Wordpress website. As the ledgers show, the Founding Fathers were more than the American political icons that they have come to embody.

Amy Beach in Grand Rapids, Michigan, 1918

Ellen Messner

Mentor:

Dr. Julia Randel,
Music

This project was supported by the Andrew W. Mellon Scholars Program.

The influential American composer Amy Beach wrote in 1915, “Our composers owe an immense debt of gratitude to the merry women’s clubs scattered far and wide over the whole land, which have done an enormous amount of work in popularizing the compositions of American musicians. They have cultivated the study and appreciation of the works of their countrymen in a most praiseworthy manner, giving them a chance for hearing alongside the works of European composers.” Among the many clubs she visited across the country was the St. Cecilia Society of Grand Rapids, Michigan where she gave a program of her compositions in January of 1918.

The St. Cecilia Music Society was one of many women’s organizations in the city which played a vital role in the rich music culture of Grand Rapids, in the decades around 1900, featuring a variety of activities including musical performances, speeches, and poetry recitations.

My project is an attempt to capture the essence of that concert. Through research in the Grand Rapids Public Library, which houses the St. Cecilia Society archives, I have pieced together the lives of those who were involved in many perspectives of the event: the club members who organized it, the performers, audience members, and a music critic. The story of the St. Cecilia Music Society and the life of Amy Beach cross paths on this occasion which now reveals to us how influential the work of Amy Beach was on the members of the Society and vice versa. This snapshot of one event offers a glimpse into a moment in time, revealing the important contributions that women have made to the arts and their communities.

The Ethics of Expropriated Art

Taylor Mills

Mentors:

Gregory Bassett,
Philosophy

Dr. Anne Heath
Art History

*Andrew W. Mellon
Scholars Program*

This project was supported by the Andrew W. Mellon Scholars Program.

Throughout the ages nations have removed art from other nations and housed such art in their own museums, raising the question of whether such expropriation is morally justifiable. This summer I investigated why art is expropriated, and how museums choose to present and display it. In addition to reading relevant literature, I visited various museums throughout Europe and informally interviewed museum visitors and staff. The goal of this project was to gain an understanding of the nature, causes, and ethical implications of art expropriation. I created an Omeka site with a Neatline map to host an analysis of my experiences and conclusions, as well as to provide a secondary means of understanding the subject via a visual, interactive platform. The map includes data points at various museums; each point’s color and size correlate to the type of art it represents and how many pieces of this type of art the museum has in its permanent collection, respectively. For example, the British Museum has a large yellow point, signifying that the museum has over 100,000 Egyptian artworks. Thus, viewers are able to see where Egyptian art is in the world, as well as compare Egypt’s collections to other nations. I formed three conclusions from this research. The first was that removing art in order to preserve it should continue, so long as the process is subject to oversight and the art is promptly returned when threats to it are eliminated and the nation of origin asks for its return. Secondly, sharing art among the global community would help maintain cultural heritage while continuing to increase and promote accessibility. Finally, museums should strive to maintain respect and cultural integrity with their displays of foreign art.

A Feminist Critique of *Cosmopolitan* Magazine

Hannah Pikaart

Mentor:

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Communication

*This project was supported
by the Andrew W. Mellon
Scholars Program.*

I hypothesize that *Cosmopolitan* magazine empowers its readers through relevant content pertaining to their lives. Starting off with rhetorical theory, I will assign meaning to this symbol using a feminist lens. So, an immediate impression of this cover is that females are inherently sexual. There are always at least three references to sex on one cover alone. From this you could infer that women are more preoccupied with men than let's say politics, which is not mentioned on the cover, but readers often find lengthy editorials inside. Additionally, the cover is predominantly pink, with a light shade used in the background, while a more intense hue highlights certain cover lines. This color is a prototypically feminine color, which is assigned to women as their color after birth. Then, lastly, the cover model, a female celebrity, strikes a pose, wearing something either skin tight or revealing. Based on description of the cover alone, I could hastily conclude that *Cosmopolitan* determines that their readers care mostly about sex, sexuality and men, rather than politics, advocacy, or money management. Therefore, was my hypothesis correct in stating *Cosmopolitan* wants to empower their reader, but primarily through their sexual lives, or does this concern with sexuality yield to the power of men, making women sexual objects?

Document-Based Learning: Outside Advanced Placement and Inside Student Minds

Miriam Roth

Mentor:

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Education

*This project was supported
by the Andrew W. Mellon
Scholars Program.*

Document-based learning (DBL) represents an exciting initiative in History Education. Long embedded in AP History curriculum and testing, the approach is now used in history classes of all levels for a variety of purposes including formative and summative assessment, development of deeper understanding of content, and foregrounding historical thinking skills. In the field, there has also been a movement to use online resources and to make DBL freely available to all teachers. Recent research, however, has highlighted (and only just begun to address) the current lack of “real-classroom studies” that examine what DBL looks like in practice. In particular, there is minimal existing research regarding student responses to DBL. Accordingly, the goal of this project is to explore and analyze student responses to DBL in order to inform the use of document-based learning in all classroom contexts. In this presentation, I will share research on what document-based learning looks like in non-AP contexts, and resources which other teachers, present and future, can access to enrich their classrooms. I will also share details and analysis of a case study on student responses to DBL which I conducted in a tenth grade American history classroom. This case study provides evidence for some of the main intended benefits of DBL as well as revealing some frustrations and concerns that students have regarding the DBL approach. The project also demonstrates the importance of student voice in understanding how DBL works in the classroom and in informing what teachers and other educational professionals can do to continue to improve the effectiveness of DBL. Ultimately, this project has implications on the field of education as a whole as its exploration of student voice reveals principles which can be applied to the research and practice of various educational approaches in all subjects.

An Analysis of Nineteenth Century Sunday School Books

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Mentors:

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Library

Dr. Anne Heath,
Art History

Dr. Curtis Gruenler,
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*This project was supported
by the Andrew W. Mellon
Scholars Program.*

The Sunday School Book genre has changed and developed throughout the centuries. In times when children of working class families received little to no schooling, these books provided an accessible source for education. During the nineteenth century, the goal of this genre was to equip its readers with a clear set of morals and values, providing even the minimally educated with a guide for how to live their lives. While few of these books became well known, and while few continue to be read and explored by audiences today, they provide monumental value in capturing, in one of the simplest (and most child-like) ways, the ideals of Protestantism throughout a century of consequential change. Michigan State University provides a collection of over 150 of these texts, all ranging in length, subject, and denominational affiliation. By visualizing our data on a Wordpress site, we are able to visually display our analysis of this collection, comparing and contrasting the information in our dataset with context brought by both religious and secular primary and secondary sources. Through this analysis, we are able to draw conclusions on how these books affected both the protestant and secular world. The argumentation of these novels, while simplistic, makes their values seem cut-and-dry. However, outside the world of Protestant Christianity, the world is clearly less black and white. But the presence of the rigid morals presented in the Protestant Sunday School books has a massive impact on the coexisting secular world.

Boston's Bicentennial Blues: How the Unraveling of Boston's Expo '76 Revealed America's Crisis of Confidence, 1967-1976

Cullen Smith

Mentor:

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English

*Andrew W. Mellon
Scholars Program*

*This project was supported by
the Andrew W. Mellon Scholars
Program and the GLCA.*

On September 9th, 1969, eight members of Boston's city council voted unanimously against a proposed Bicentennial exposition of grand proportion. For more than three years, Boston's public planners had fought to establish Expo '76, the ambitious urban project, as a proposal for a World's Fair exposition within America's Bicentennial year. Council members stated that the site of the exposition was "unsuitable" and that the exposition's financing scheme was not in the "best interests" of the city of Boston. Superficially, it appeared that financial misgiving or poor timing was the cause of the panel's decision. But there was more to the decision than that. Boston's malaise over its proposed commemorative exposition serves as a case study of America's soul searching throughout its Bicentennial years.

My research elaborated upon the unexplored story of 1976 Boston's Bicentennial celebration. By producing a scholarly paper and accompanying website, this project provided a 21st-century lens upon which to view the Bicentennial and its context in 20th-century American history. My project was a thematic extension of my previous research, as I transitioned from exploring the Vietnam War's impact upon Holland to one on a larger national scale: Boston. This project highlighted the impact of the Vietnam War, but more importantly, it explored the emphasis placed on recovery instead of disillusionment during this era. It was my intention to answer the question: "To what degree did the preparation and execution of Boston's Bicentennial celebrations reflect or deflect a national atmosphere of disillusionment?"

The Man Who Wore Red: Allen Stringfellow

Nia Stringfellow

Mentor:

Linda Graham, MFA,
Dance

This project was supported by the Andrew W. Mellon Scholars Program and Department of Dance.

Known as the man who wore red, Allen Stringfellow (1923-2004) is an African American collage and water-color artist. His pieces are memorable for their radiant energy and vibrant colors, particularly the color red, which became a signature character for his work. By learning from Stringfellow's childhood and history of Chicago, we can begin to understand the depths he pulled his influences from to bring his art to life, ringing through the paintings and collages that brought a sense of pride for African-Americans across the nation. Much of Stringfellow's work sheds light into the Chicago black community and how it developed its own character of nightlife and artistry. With his father owning a jazz club in Chicago, we can see how those childhood experiences shaped his image about jazz and jazz musicians who are portrayed in his artwork. Stringfellow was also raised in the church with his grandmother, witnessing numerous water baptisms. The bright colors and elaborate patterns in the clothes of painted black women symbolize the pride, dignity, and strong Christian faith the women held in 20th century American society. Stringfellow explains in an interview that even if you were poor, you always looked your best on Sunday mornings. The artist celebrates the unique blend of jazz and church lifestyles seen in every spirited occasion.

In order to gather information about Allen Stringfellow, I compiled his artwork from multiple art-buying websites. I listened to interviews where Stringfellow discusses the intentions behind his paintings. In the pursuit to learn more about his childhood and adult lifestyle that may have influenced his art, I interviewed one of his nieces and received more first-hand experience and biographical information that expanded my research to a sacred depth.



Effects of Ketamine on Manic/Depressive Behaviors in Homocysteic-acid Treated Rats

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Brandon Ellsworth
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Isaiah Hough
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Mentors:

Dr. Christopher Barney,
Biology

Dr. Leah Chase,
Biology, and Chemistry

This research was supported by the Departments of Biology and Chemistry and the Neuroscience Program at Hope College.

Previous work in our laboratory has shown that demonstrated that male and female rats that receive daily intraperitoneal injections of the endogenous, glutamatergic agonist homocysteic acid (HCA) from postnatal day 3-21 develop behaviors that are consistent with a mixed depressive/manic phenotype. Specifically, HCA-treated rats exhibit anhedonia in a saccharine preference test and reduced social interactions consistent with a depressive phenotype. In addition, these animals also exhibit increased locomotion and risk-taking behavior in novel environments and increased goal-directed behavior in the Morris Water Maze. We have previously hypothesized that the behaviors elicited by HCA treatment may suggest that we have developed a novel animal model for bipolar disorder. We have shown that treatment of our model animals with lithium, a drug used in the treatment of bipolar disorder, reversed the manic-like behaviors associated with HCA-exposure. The lithium treatment reduced time the HCA-treated animals spent in the open arms of the elevated plus maze and hyperlocomotive behavior in novel environments. In the current study, we determined if ketamine, a drug that rapidly reverses depression in humans and depressive-like behaviors in rats, would reverse the depressive-like behaviors in HCA-treated animals. We tested the effects of ketamine on motor behavior (Rotarod), hedonistic behavior (sucrose preference), exploratory behavior and anxiety (elevated plus maze), depressive-behavior (forced swim) and social behavior (social interaction) in male and female HCA-treated rats. The results of these tests will be presented and discussed.



Effect of Lithium Treatment on Homocysteic Acid-Induced Manic/Depressive Behaviors in Sprague-Dawley Rats

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Ryann Felton
Jada Royer
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Dr. Christopher Barney,
Biology

This research was supported by the Departments of Biology and Chemistry and the Neuroscience Program at Hope College.

Bipolar disorder is a mood disorder for which the development of new treatments has been hindered by the lack of a reliable animal model. Previous studies in our lab have shown that daily injection of early postnatal rat pups with homocysteic acid (HCA), a homocysteine metabolite, leads to a mixed manic/depressive phenotype in adulthood. These results suggest that early HCA exposure may serve as a good model for bipolar disorder. To test the predictive validity of this model, we sought to determine if treatment of HCA-exposed animals with lithium was effective in reducing mixed manic/depressive behaviors elicited by HCA. As predicted, lithium treatment resulted in diminished manic-like behaviors in the HCA-treated rats and restored spatial learning in the Morris water maze of female, HCA-treated rats. Lithium also increased saccharine preference in female, HCA-treated animals and social activity in male, HCA-treated animals. However, lithium caused a reduction in saccharine preference and social behavior in the saline-treated rats. Finally, to determine if the effects of lithium were reversible, we removed the lithium from the rats' diet for ten days and repeated the behavioral assessment. Removal of lithium resulted in the re-establishment of manic behavior in the elevated plus maze and a reduction of spatial learning in HCA-treated rats. However, the effects of lithium on the depression-associated behaviors of HCA-treated animals were not reversed, and all animals exhibited a strong increase saccharine preference and social behavior compared to when they were fed lithium. Thus, our results suggest that lithium is effective in treating the manic behavior, spatial learning deficits, anhedonia and reduced social interaction elicited by HCA as hypothesized. Collectively, these data provide further evidence that early postnatal exposure to HCA may serve as model for the mixed manic/depressive phenotype associated with bipolar disorder.



Investigating the
Influence of Oxytocin
Receptor Genotype on
Receptor Sensitivity—
an In Vitro Study

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Morgan Cinader
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Mentor:

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Abstract not available online.

Exposure to Homocysteic Acid Early in Postnatal Development Leads to a Mixed Depressive/Manic Behavioral Phenotype and Changes in NMDA Receptor Expression

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Biology

This research was supported by the Departments of Biology and Chemistry and the Neuroscience Program at Hope College.

Homocysteic acid (HCA), a NMDA receptor agonist, is an endogenous metabolite formed from the oxidation of homocysteine. Since hyperhomocysteinemia is a risk factor for several neuropsychiatric disorders, including bipolar disorder and major depressive disorder (MDD), we tested the hypothesis that elevated HCA levels in developing rats may induce alterations in NMDA receptor expression and the development of associated behaviors. Twenty postnatal male and twenty female rats were injected daily with either HCA or saline from P3 to P21. HCA-treated rats displayed increased risk-taking behavior, reduced social behavior, novelty-induced hyper-locomotion, anhedonia, and reduced spatial learning, consistent with a depressive state with manic tendencies. As expected, HCA treatment had no effect on motor coordination or paired-pulse inhibition. In addition to these behavioral changes, we observed that HCA led to an increase in expression of the GABAergic marker, GAD-67, in the cortex, but not the hippocampus, of both male and female rats. In the cortex, we also observed that HCA triggers a significant increase in the NMDAR2b:NMDAR2a subunit expression ratio in male rats, while female rats exhibited a decreased ratio. The results suggest that HCA triggered an increase in NMDAR2a expression in the hippocampus of both males and females. Finally, HCA also led to a decrease in NMDAR2b expression in females, but an increase in NMDAR2b expression in the hippocampus of males. We are currently examining the effect of HCA exposure on NMDAR1 subunit expression. Collectively, these data suggest that early postnatal exposure to HCA may lead to a mixed manic/depressive phenotype that may be accompanied by GABAergic signaling changes in the cortex. Given the proposed regulatory role of NMDA receptors on GABAergic interneuron activity and mood, we suggest that this may serve as a novel animal model for studies of complex mood disorders, such as bipolar disorder or MDD.

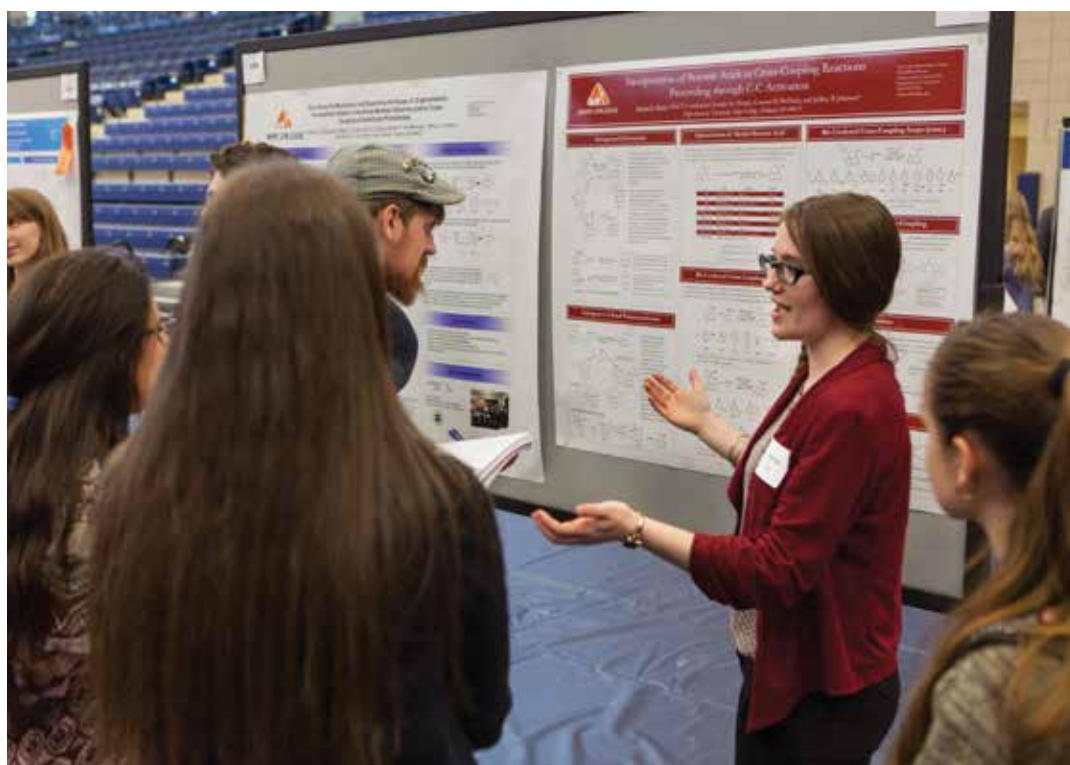
Homocysteine Exposure in Early Postnatal Rats Leads to an Incomplete Bipolar Disorder Phenotype

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Sarah Carrara
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Sarah Faith Kim
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Katie Pniewski
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Elevated levels of plasma homocysteine have been linked to neuropsychiatric disorders such as Bipolar Disorder. Therefore, we sought to determine if homocysteine itself would lead to a bipolar-like phenotype. We fed lactating rats either a high homocysteine/low vitamin B diet (HCY) or a standard rat diet, and examined the behavioral effects on the offspring. We assessed the rats for altered risk-taking behavior, activity level, anhedonia, learned helplessness, social behavior, goal-oriented motivation and spatial learning. In the elevated plus maze, we observed a significant increase in time spent and distance traveled in open arms of HCY rats compared to control rats, suggesting increased risk-taking behavior. We did not observe hyperactivity in the HCY rats in the elevated plus maze, wheel running assay, or social interaction test. In the saccharin preference test, HCY-treated rats consumed a significantly lower saccharin:water ratio than control rats, demonstrating anhedonia. We did not observe any differences in learned helplessness in the forced swim test between control and HCY treated animals. There was no effect of HCY treatment on social interaction; however, the HCY treated animals spent significantly more time interacting with both cages in the first trial than control rats, suggesting increased curiosity. There was no effect of HCY on goal-oriented motivation and/or spatial learning in the first day of Morris Water Maze testing. However, HCY treated animals took significantly longer to complete the maze on the first trial of day two, suggesting HCY reduced spatial memory. These results suggest elevated HCY triggers features of Bipolar Disorder such as anhedonia and increased risk-taking behavior. However, exposure to HCY did not elicit hyperactivity, learned helplessness, increased goal-oriented behavior, or altered social behavior, implying that HCY alone is not sufficient to produce a complete bipolar-like phenotype.



Inclusivity or...?: A Multi-Lens Feminist Analysis of H&M's She's a Lady Commercial

Rachel Barszcz

Mentor:

Dr. Kendra Parker,
English

In September 2016, clothing company H&M released an ad seemingly unparalleled in terms of diversity. With the release of this minute-long commercial, the company projected a message of inclusivity to the public, and redefined the word “lady” by including women of different races, body types, and walks of life. However, upon a closer inspection, one can see that key demographics are not represented in this ad—such as women with physical disabilities. Furthermore, H&M is known for labor practices which fail to empower women in the ways which this ad would suggest. This study explores intersectionality within the ad via feminist disability and postcolonial feminist lenses. Analysis of this ad was conducted by repeated viewing of the commercial and its critical scenes, as well as by bringing in work from other scholars to explore H&M’s values and practices. This study aims to critique what is shown as well as what is absent from the ad. By evaluating both positive and negative aspects of H&M’s “She’s a Lady” commercial, I hope to emphasize the importance of viewing media with a critical eye, and diving beneath the surface when consuming such content.

When Will “Real Bodies” Mean All Bodies?: A Critical Look at the #AerieREAL Ad Campaign

**Sophia
Bouma-Prediger**

Mentor:

Dr. Kendra Parker,
English

Amidst our society’s overt sexualization of women’s bodies, especially in the media and advertising industries, some brands are fighting back. American Eagle’s intimates brand, Aerie, is one of them. In 2014 Aerie launched their #AerieREAL campaign, pledging not to retouch the models in their ads, breaking norms and portraying “real” bodies. In this research I explore the areas in which this campaign succeeds and in which it falls short. While the #AerieREAL campaign does some things well, and is in fact making progress for body positivity in its industry, it still perpetuates mainstream beauty standards, portrays overt femininity, reinforces an able-bodied view of the world, is inherently consumerist, and supports the sexualization of female identities. Using feminist perspectives, I analyze the campaign’s choice of models and use of an overtly feminine color palette, calling attention to the inherent consumerism behind these ads- the sale of goods through the sexualization of women’s bodies. Meanwhile, feminist disability theory brings to light the ableism present behind the portrayal of bodies in the campaign. With these diverse lenses in mind, I pose the question- how do we as consumers approach this campaign?

Coca-Cola: Bottling Happiness

Alissa Heynen

Mentor:

Dr. Kendra Parker,
English

Over the years, sexism, racism, and heterosexism have begun leaking into commercials and advertisements due to an excuse that these ideas are necessary to sell products. This study focuses on the representation in Coca-Cola’s “Taste the Feeling” campaign released in January of 2016. By showing commercials that feature mainly straight, white, beautiful, cisgender, and heterosexual characters, Coca-Cola fails to acknowledge a majority of people around the globe. The company has forced target groups of people to see themselves in this majority lens without giving representation to all and therefore invalidating individuals’ own unique life experiences. Research found that Coca-Cola deliberately included actors of certain races, ethnicities, and sexualities to target specific demographics within their target market.

Effects of VACM-1/
Cul5 Gene Knockout
on Cellular Prolifera-
tion Using CRISPR/
Cas-9 Approach

Abstract not available online.

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The Neddylation Site
in VACM-1/CUL5
Sequence Regulates
Its Effects on
Cellular Growth
and Angiogenesis

Abstract not available online.

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by the Borgeson Fund for
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Undergraduate Research.*

Regulation on
VACM-1/CUL5
Neddylaton by LPS
(Lipopolysaccharide)

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Abstract not available online.

System Xc⁻ - Regulation:
Effects of Mutations
on Membrane
Expression and
Ubiquitination Status

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the Hope College Biology
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System xc⁻ exchanges intracellular glutamate for extracellular cystine across the membrane of many cell types, including astrocytes. Its activity directly regulates the synthesis of the antioxidant glutathione and the extracellular concentration of glutamate in some areas of the brain. We recently demonstrated that oxidants acutely upregulate System xc⁻ activity by triggering the rapid redistribution of the transporter from intracellular compartments to the cell surface. Our current work suggests that the trafficking of the transporter may be regulated by ubiquitination and that oxidant exposure directly influences the ubiquitination of the transporter. In this study we sought to test the hypothesis that the ubiquitination status of the transporter regulates both its cell surface expression and activity. We have used a mutagenesis approach to disrupt putative ubiquitination sites and a putative ubiquitin ligase binding site within a myc-tagged System xc⁻ construct so that we can understand the role ubiquitination plays in regulating the cell surface expression of System xc⁻. There are seven highly conserved lysine residues within xCT that are located on the cytoplasmic side of the membrane. We have created mutant forms of this construct containing single or multiple lysine to arginine mutations so that we could assess the effect of these mutations on cell surface expression of System xc⁻. Using biotinylation assays and immunocytochemical analysis, we have demonstrated that mutation of the N-terminal lysine residues increases the cell surface expression of the transporter. In addition, we have identified a putative ubiquitin ligase binding site in the Inbox (2)C-terminus of the transporter. Disruption of this binding site also leads to an increase in cell surface expression of the transporter. Collectively these data suggest that System xc⁻ is regulated by changes in its ubiquitination status such that factors which lead to diminished ubiquitination will allow for increased cell surface expression of the transporter.

Activation of System xc- Trafficking via an Akt-dependent Signal Transduction Pathway

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Mentor:

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System xc- is a heterodimeric plasma membrane transporter involved in the exchange of intracellular glutamate for extracellular cystine. As such, this transporter plays a critical role in the production of the antioxidant glutathione. Previous studies in our lab have demonstrated that xCT cell surface expression increases within ten minutes of exposure to H₂O₂ in confluent U138MG human glioma cells. This study sought to begin to characterize the mechanism by which H₂O₂ regulates xCT trafficking. We hypothesized that Akt signaling is necessary for H₂O₂-mediated trafficking of xCT. A significant increase in Akt phosphorylation was observed in U138MG cells following ten-minute exposure to 3 mM H₂O₂ compared to vehicle-treated cells using western blot analysis. Treatment with the Akt inhibitor 10-DEBC (2.5 μM) for 30 minutes prior to and during H₂O₂ exposure resulted in a decrease in H₂O₂-induced phosphorylation of Akt at Ser473. Similar inhibition of Akt phosphorylation at Thr308 was observed following treatment of cells with 1.0 μM API-2. Next, we used simultaneous treatment of cultured glioma cells with both inhibitors in the presence of H₂O₂ to determine if such treatment led to a reduction in the trafficking of endogenously expressed xCT to the plasma membrane. Preliminary data suggests that Akt activation is necessary for H₂O₂-induced trafficking xCT to the membrane in cultured glioma cells. To determine if the regulation of xCT cell surface expression is ubiquitous, not limited to human glioma cells where xCT is often overexpressed, we studied the role Akt plays in the trafficking of recombinantly expressed xCT in COS-7 cells. COS-7 cells transfected with myc-tagged xCT, 4F2HC and a constitutively active form of Akt showed higher levels of xCT localized to the membrane compared with cells transfected with a dominant negative Akt. These data suggest that Akt is an important regulator of xCT cell surface expression.

Welcoming a Greener Campus? It's Up to You!

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Christopher Kruger
Regan Jekkals
Chelsea Steinfeldt
Marissa Marks

Mentor:

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Biology and Education

This research supported by the Holland-Hope College Sustainability Institute, with funding from the Local Sustainability Matching Fund, a project of the Funders' Network for Smart Growth and Livable Communities, in partnership with the Urban Sustainability Directors Network and the Community Foundation of the Holland/Zeeland Area.

Reducing energy consumption has proven to be a challenging objective for national, state, and municipal level legislation. Furthermore, colleges have struggled in this area due in part to the lack of student fiscal accountability for energy use and difficulties adapting aging structures and buildings to modern energy efficiency standards. Clearly, no single program will solve the problem. Nonetheless, significant steps can be taken to reduce electricity and water usage on college campuses. In the current study, researchers investigated the energy efficiency of Hope College cottages as well as the electricity and water usage habits of cottage residents. In March of 2016, sixteen students, all living in different college-owned cottages, responded to an email containing a self-assessment energy survey. In addition to the survey, third-party energy efficiency assessments of Hope College cottages were performed. These assessments considered the cottages' physical conditions, heating/cooling systems, and hot water systems. Analyzed using both quantitative and qualitative methods, the data suggests that many cottages need significant upgrades, and Hope College students could contribute to a greener campus by changing several habits that waste electricity and water. Reviewing studies from other campuses and survey responses from Hope students allowed researchers to generate a list of possible social and administrative initiatives that could help improve students' energy stewardship. These suggestions include awareness campaigns, residential energy competitions, and making recycling more comprehensive and cohesive across campus. By understanding the need to balance structural modifications and more responsible residential behavior, we can all reduce electricity and water usage and welcome greener actions at Hope College.

Assessing the Role of Endophytic Fungi in Canada Wildrye Grass

Joshua Briggs
Santiago Rios
Carter Wolff

Mentor:

Dr. Thomas Bultman,
Biology

Endophytes are microbial species that live within a plant asymptotically. Some fungal endophytes have developed a symbiotic relationship with cool-season grasses. It has been suggested that these symbiotic fungi cooperate in a defensive mutualism with their host grasses by producing alkaloids. The alkaloids deter various types of herbivores. The objective of this study was to determine the level of mutualism present in these relationships, and whether different endophyte isolates influence the level of mutualism. Specifically, we examined the effect these endophytic fungi exert on insect abundance, insect herbivory, and plant growth in Canada Wild Rye (*Elymus canadensis*), a grass native to North America.

Seeds were collected from Carleton College Prairie in Northfield, Minnesota. These seeds consisted of several experimental groups: those naturally uninfected, those naturally infected, and those artificially disinfected with *Epichloe canadensis*. These groups were studied in both outdoor and indoor laboratory trials. As a bioassay for alkaloid activity, we utilized Bird-Cherry Oat Aphids (*Rhopalosiphum padi*). In the field experiment, twenty-four plants were assigned to a treatment group, and insects were collected via vacuum sampling. Visual estimates of herbivore damage were performed. In the indoor aphid bioassay, twenty-five plants were assigned to each treatment group and apterous aphids were placed on grasses, and scored for survival and reproductive success. These experiments were performed during 2015 and 2016.

In the 2015 bioassay experiment, fewer aphids were present on grasses with endophyte infection. This result was mirrored in the field experiment when feeding by sucking insects was analyzed. In the 2016 bioassay, we found that removal of endophyte from grasses made them more susceptible to aphids. Contrary to our expectations, the presence of endophytic fungi did not enhance plant growth in the field experiment for either year.



Specific Lipid Requirements and Localized Lipid Composition Changes Associated with Flock House Virus RNA Replication in *Drosophila* Cells

Haley Fischman
Natalie Filipowicz
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Mentor:

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This research was supported in part by an award to Hope College from the Howard Hughes Medical Institute through the Undergraduate Science Education Program. Further support comes from the Hope College Biology Department, the Dean for Natural and Applied Sciences, and the Dow Scholars Program.

Positive-strand RNA [(+)RNA] viruses are significant human pathogens. A universal feature of (+)RNA viruses is that they replicate their genomes in association with host intracellular membranes. This association may be a target for broad spectrum antivirals against (+)RNA viruses. The (+)RNA virus used in our studies is the alphanodavirus Flock House virus (FHV). FHV is a simple (+)RNA virus with a 4.5 kb bipartite genome that replicates in insect cells. FHV replicates its RNA genome at the outer mitochondrial membrane of infected cells where it forms 50-70 nm in diameter invaginations that are membrane-bound RNA replication complexes. Previous work by others has shown an increase in the amount of phosphatidylcholine in FHV infected cells. Additionally, decreasing the amount of phosphatidylcholine in *Drosophila* cells thru targeted down regulation of biosynthetic genes decreased FHV replication. We hypothesized that increased levels of phosphatidylcholine were required for the formation and maintenance of the membrane-bound replication complexes located at mitochondria. To test this hypothesis, we synthesized the choline analog, propargylcholine, which is incorporated into phosphatidylcholine and can be “tagged” using copper(I) catalyzed cycloaddition chemistry. FHV infected cells were incubated with propargylcholine, tagged with a fluorescent dye, and visualized with confocal fluorescence microscopy. Our results suggest that there is an enrichment of phosphatidylcholine at the sites of FHV RNA genome replication. Additionally, we determined that two other major classes of cellular lipids, phosphatidylethanolamine and phosphatidylserine, were not enriched at FHV genome replication sites. Ongoing work includes a quantitative analysis of the mitochondrial lipid composition of FHV infected cells. Our work provides support for the importance of specific lipids in (+)RNA virus genome replication and the possibility that lipid biosynthetic pathways may be good antiviral targets.

Seasonal Variation in Microbial Populations in Lake Macatawa Watershed

Ford Fishman
Abbygayle Parshall
Nestor Barrera
Prescott Binder
Max Huffman
Abigail Jeavons
Andrew Klein
William Kleinheksel
Mallory Luke
Elizabeth Morehead
Clay Sanders
Adam Slater
Cleveland Tarp
Benjamin Turner

The levels of fecal indicator bacteria (FIB), specifically *Escherichia coli*, are used by the mDEQ and other organizations to monitor water quality and safety. Transient large spikes in the numbers of *E. coli* have plagued the Lake Macatawa Watershed over the last decade, along with high sediment levels and nutrient imbalances. Project Clarity, a \$12M restoration project initiated in 2013, is working to restore the 179 mi² watershed by creating remediation sites and educating the community. Our goal is to assess Project Clarity’s impact on water quality by collecting weekly samples from 12 representative sites to gather information about biological, chemical, and physical parameters. Total DNA samples are isolated each week using membrane filtration and the V4 region of the 16S rRNA gene is amplified for 16S community sequencing. Physical and chemical parameters including total suspended solids, nutrients (phosphate and nitrate), temperature, stream discharge, dissolved oxygen, and biological oxygen demand are measured and correlated to the composition of the watershed’s microbiome. Microbial community composition varies seasonally and with location in the watershed. In particular, stream sites are distinct from sites in Lake Macatawa. Large populations of cyanobacteria with the potential to cause toxic algal blooms are present in some lake sites at certain times of the year. In addition to using the 16S community sequencing as a monitoring technique, it may also allow us to identify other organisms that can be used to monitor water quality and safety through non-culture based techniques.

Mentors:

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Biology

Dr. Mike Pikaart,
Chemistry

Sarah Brokus
Day1 Research Program

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Randy Wade;
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This research was supported by the National Science Foundation under grant No. MCB-11616737 and the Herbert H. and Grace A. Dow Foundation.



Genotyping Methods: OXTR rs53576

Abstract not available online.

Trechaun Gonzalez
Elliott Johnson

Mentors:

Dr. Gerald Griffin,
Biology

Dr. Charlotte vanOyen
Witvliet,
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Genomic Analyses of the Novel Mycobacteriophage Opia

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Dr. Aaron Best,
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Dr. Joseph Stucky,
Biology

*This research was supported
by the Howard Hughes
Medical Institute
SEA-PHAGES Program.*

Eighteen new mycobacteriophages were isolated from soil samples collected around the state of Michigan and parts of the United States. All phages were capable of infecting *Mycobacterium smegmatis* and were isolated through either enrichment or direct plating at 32°C or 37°C. A variety of plaque morphologies were produced based on size, shape, and clarity; both lytic and temperate phages appear represented in this collection. The mycobacteriophage, Opia, was chosen as one of three phages for complete genome sequencing and comparative genomic analyses. The predominant plaque produced by Opia at 37°C was circular and approximately 1 mm in diameter. The complete genome sequence for Opia revealed relationships to members of the Cluster B2, which contains 22 sequenced members to date. The genome of Opia is 67.4 Kb, 68.9% GC, and contains 93 genes. Phages in Cluster B2 share very high sequence identity throughout the genomes lengths. Opia maintains this pattern, being nearly identical to phages Glass, Rosebush, and Hedgerow despite isolation of the phages in different years (15 year span) and in different geographical locations. A detailed analysis of the complete genome sequences and comparison with sequenced mycobacteriophages is the subject of the second semester of this yearlong course and is presented.

Level of Fly Vector Mutualism Depends on *Epichloë* Reproductive Strategy

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Mentor:

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This project was supported by the National Science Foundation under grant No. NSF-IOS #1119775.

Botanophila flies act as pollinating predators of sexually reproducing *Epichloë* fungi, and were found to be the main vectors of fungal gametes; however, other vectors and methods of fertilization have been suggested. We hypothesized that this discrepancy is due to different types of reproductive modes used by different species of *Epichloë*. We hypothesized that type I fungi (which only reproduce sexually) will depend less on *Botanophila* flies for spore transfer, as it is more risky for these fungi if the fly fails to fertilize. However, type II fungi (which reproduce both sexually and asexually) can afford to take the risk of the fly failing, since they have a “backup” mode of reproduction (asexual). We observed the interaction between *Botanophila* and *Epichloë typhina* (a type I species) at our field site in the forest of Phalempin, France to determine the level of dependence between the fly and fungus. As expected, egg numbers on the stromata were high at the beginning of the study, but dropped off as eggs hatched and larval numbers increased. Feeding by both fly larvae and other fungivores increased over the study period. Unlike past studies from our lab, that found that the fly was the main vector for cross fertilization of type II fungi, we found no net benefit to the fungus of having the fly visit *Epichloë typhina*. This is consistent with studies published by other labs and with our hypothesis that the mutualism of *Botanophila* is based on reproductive mode.

Temperature Effects on a *M. tuberculosis* infectious Subset of Mycobacteriophages

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Gloria Chang
Alison Rhodes
Bethany Van Houten**

Mentor:

Dr. Joseph Stuke,
Biology

Mycobacteriophages are viruses that infect mycobacterial hosts. Over 1300 mycobacteriophages have been organized into at least 34 distinct groupings or clusters based on genomic sequence similarity. Some mycobacteriophages from Clusters A and K can also infect *Mycobacterium tuberculosis*, a distinction of potential medical importance. Recently, Hope College SEAPHAGES students have been isolating predicted Cluster K phages at a higher frequency ($\geq 2x$) after changing the isolation temperature from 37°C to 32°C. Additionally, these phages were unable to propagate at 42°C. PCR analysis supported a Cluster K classification for many predicted Cluster K phages isolated at 32°C, but for only one of the phages (Ruthiejr) isolated at 37°C. Interestingly, Ruthiejr does propagate at 42°C. We hypothesized that Cluster K phages may have a relative growth advantage at lower temperatures. We investigated temperature-dependent growth properties of several known and PCR-supported Cluster K mycobacteriophages. We examined phage thermostability, adsorption rate, reproductive cycle time (latent period), and burst size. Stability at 42°C appeared phage-dependent and was not always consistent with growth temperature profiles and/or host adsorption kinetics. For example, phages Bella96 and Krueger, both growth-defective at 42°C, also displayed reduced thermostability and host adsorption kinetics at 42°C compared to lower temperatures. In contrast, phages Polymorphads and Hyperbowlee, also growth defective at 42°C, were nonetheless stable at 42°C. Notably, Hyperbowlee also showed almost no host adsorption at 42°C. One-step growth analysis of D29 (control), Bella96, and Krueger showed impaired growth of the Cluster K phages at $\geq 37^\circ\text{C}$ compared to D29. These results now suggest that Cluster K phages may have a growth disadvantage at temperatures $\geq 32^\circ\text{C}$. Our findings provide insight into the growth behavior and temperature sensitivity of Cluster K phages and may lead to discoveries about *M. smegmatis* and *M. tuberculosis* infection by mycobacteriophages.

Monitoring Nutrient Levels and Sediment in Lake Macatawa Watershed

Prescott Binder
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This research was supported by the National Science Foundation under grant No. MCB-11616737 and the Herbert H. and Grace A. Dow Foundation

Project Clarity, a \$12M restoration project initiated in 2013, works to restore the 179 mi² hypereutrophic Lake Macatawa Watershed. Our goal is to assess Project Clarity's impact on water quality by collecting weekly samples from 12 representative sites. Physical and chemical parameters including total suspended solids, nutrients (phosphate and nitrate), temperature, stream discharge, dissolved oxygen, and biological oxygen demand are measured and correlated to the composition of the watershed's microbiome. The watershed's physical and chemical parameters vary. For example, during large rain events there are rapid surges in stream height and discharge. Project Clarity implements best management practices for land use in an attempt to minimize the impacts of rain events large enough to produce heavy runoff. Runoff often carries large amounts of fine grained sediment that has the tendency to adsorb nutrients. Most of these sediments end up entering nearby waterways, causing a decrease in water quality. Excess suspended solids strain aquatic populations by increasing temperature and decreasing dissolved oxygen and clarity. Measuring sediment as total suspended solids allows for approximation of sediment loading and transport. TSS levels in the fall of 2016 averaged around 15 mg/L, with maximums as high as 125 mg/L at a stream site during a rain event. The MDEQ found the average phosphorus concentration in Lake Macatawa was 0.125 mg/L Phosphorus in 1997, and set the goal total maximum daily load (TMDL) to reach 0.050 mg/L P by 2009. To date, this TMDL has not been consistently met. Phosphorus levels in Lake Macatawa averaged 0.065 mg/L during our fall 2016 monitoring. Additionally, nitrate levels are somewhat elevated. These data provide a baseline of water quality characteristics for monitoring remediation efforts in the watershed. Correlations between data are explored for potential influence on large-scale biogeochemical cycling.

Generation of a Zika Virus Reverse Genetics System for *Drosophila melanogaster*

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Emily Salazar**

Mentor:

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Biology

Zika Virus (ZIKV) is a positive-strand RNA [(+)RNA] arbovirus of the flavivirus genus that has recently caused a global health crisis associated with an increase of primary microcephaly, a congenital anomaly correlated with brain size and development. In this work, we are attempting to create a plasmid-based reverse genetics system for ZIKV that is functional in insect cell lines, specifically *Drosophila melanogaster*. Several plasmid-based ZIKV reverse genetics systems have been established for mammalian systems, though they do not work in insect cells due to incompatible promoters. Establishing *Drosophila* as a model insect system for ZIKV would allow us to take advantage of *Drosophila*'s fully sequenced and well-annotated genome and the many tools available for genetic manipulation. Initial attempts to construct a plasmid-based reverse genetics system indicated toxicity of ZIKV sequences in *E. coli*, consistent with the findings of others. Using the 1947 ZIKV cDNA plasmid developed by Schwarz et al. we replaced the cytomegalovirus (CMV) promoter with the baculovirus immediate early 1 (IE1) promoter. The IE1 promoter works well in *Drosophila* S2 cells and has been used for other (+)RNA virus insect cell replicon systems. Surprisingly, the presence of the IE1 promoter resulted in toxicity in *E. coli* despite the presence of introns and using a low-copy number plasmid backbone. Next, we replaced the CMV promoter with the *Drosophila* actin 5c promoter. Initial results indicate that this plasmid is stable in *E. coli*. We are currently testing this replicon system for ZIKV replication in *Drosophila* S2 cells.

Elucidating the Anti-Tumor Mechanisms of Naturally Derived Capsaicin

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Mentor:

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Biology

Neuroblastoma is an extra-cranial solid cancer that primarily affects children. Aggressive neuroblastoma tumors typically demonstrate resistance to conventional chemotherapeutic and radiotherapeutic regimens. The *Capsicum chinense* pepper fruit is heavily grown and consumed by indigenous people in the southern Americas, southeastern Asia, and West Africa. Multiple reports have pointed to the pepper fruit to have multiple health benefits, including the ability to combat cancer. Combining these findings with the need for novel and safer pediatric cancer treatments, this study tested if *Capsicum chinense* pepper fruit extract has therapeutic potential for neuroblastoma. More specifically, we tested the hypothesis that capsaicin and dihydrocapsaicin-containing extracts from *Capsicum chinense* decreased viability of neuroblastoma cells. To test this hypothesis, ripe *Capsicum chinense* red fruits were grounded to paste and weighed. Next, the capsaicin and dihydrocapsaicin components were extracted using hexane. Then, a range of concentrations (1pg/mL–100 mg/mL) of the extract was administered to cultured SH-SY5Y neuroblastoma cells. Lastly, the trypan blue assay was conducted to measure cell viability. Our findings showed that capsaicin and dihydrocapsaicin-containing extract from *Capsicum chinense* reduced neuroblastoma cell viability in a concentration-dependent manner with an IC₅₀ of 69.75 µg/mL. These results illustrated that *Capsicum chinense* extract containing capsaicin and dihydrocapsaicin is effective in reducing viability of neuroblastoma cells in vitro and may serve as a naturally derived treatment source for this pediatric cancer.

The Effects of Diet on Anxiety in the Prefrontal Cortex

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Biology

According to the Center for Disease Control, obesity is a growing epidemic with more than one third of the U.S. adult population being obese. Moreover, the National Institute of Mental Health reports that anxiety disorders exist in 18% of U.S. adults. Anxiety and obesity are often comorbid with anxiety often being attributed to the social stigma surrounding obesity. Our goal is examine the physiological changes following high fat diets or the development of obesity to determine if these changes may lead to anxiogenic behavior. We utilized male Sprague-Dawley rats to perform both behavioral and biochemical analyses. Following this ad libitum high fat diet treatment, rats underwent anxiety-related tests including the Elevated Plus Maze and the Open Field Test. Western blots were conducted on PFC tissue to explore potential differences in the protein levels of corticotropin releasing factor receptor 1 (CRFR-1) following diet manipulation. CRFR-1 receptors play an important role in the stress response and has been found to be altered in obese individuals.

Amyloid Beta Requires Oligomerization to Limit the Growth of *Salmonella enterica*

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Tyler Dempsey
Brandon Ellsworth**

Mentor:

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Biology

Alzheimer's Disease (AD) is the sixth leading cause of death in the United States. In fact, one out of every eight Americans age sixty-five and older will develop the disease. One pathological hallmark associated with AD and other forms of dementia is the over-accumulation of the amyloid beta peptide. This excess of amyloid beta leads to the peptide's oligomerization, ultimately leading to neuronal loss. While amyloid beta is present at low levels in all humans, its function is a source of great debate. A growing number of reports has demonstrated that amyloid beta has antimicrobial properties. To extend these findings, we tested the hypothesis that amyloid beta exerts antimicrobial activity against *Salmonella enterica* (*S. enterica*). Additionally, our work tested whether 2-amino-4-chlorophenol (2a4cp), a compound that prevents amyloid beta oligomerization, affects the antimicrobial function of the peptide. After treating *S. enterica* with a range of concentrations (1pM-1μM) of both major isoforms of amyloid beta (1-40 and 1-42), we measured bacterial cell viability with the Alamar Blue assay. Our results revealed that the 1-42 isoform ($F=32.91$, $p<0.001$), but not the 1-40 isoform of amyloid beta, limited bacterial growth. Moreover, 2a4cp co-administration decreased amyloid beta's ability to limit the growth of *S. enterica*. Altogether, these findings indicate that amyloid beta oligomers are responsible for the antimicrobial abilities of amyloid beta.

Effects of Junk Food Diet and High Fat Diet Manipulation on Working Memory of Sprague Dawley Rats

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Dr. Peter Vollbrecht,
Biology

Obesity has become not only a nationwide problem, but a cause for worldwide concern as the prevalence of processed junk-food is currently on the rise. Along with numerous physical ailments induced by obesity, emerging evidence suggests that consumption of a high-fat diet has negative neurological implications. The prefrontal cortex (PFC), known to play an important role in mediating “executive” functions such as inhibitory control, working memory, and decision-making is one region that appears to be affected by consumption of a junk food diet. In this study, we explored the effects of a junk-food diet and a high fat diet on PFC function. Rats were fed either a junk-food diet (19.6% fat) intended to mimic a typical Western diet, a high fat diet (60% fat), or a standard chow diet. Behavioral testing were then conducted following a 4 week exposure to the diets and included the Egocentric Morris Water Maze, Spontaneous Alternation, Novel Object Recognition and Attentional Set Shift. These behavioral tests were performed in order to identify any differences in working memory or attention between groups.

Protein expression differences in the PFC following diet exposure were explored via western blot. BDNF is a neuropeptide that aids in neurogenesis and synaptic plasticity, therefore playing an important role in working memory and other PFC functions. Another protein of interest is the astrocytic glutamate transporter GLT-1. GLT-1 is credited with over 90% of glutamate uptake from the synapse and deficits in its proper functioning is known to cause excitotoxicity and eventual neuronal death. Biochemical and behavioral analysis of our data will help to determine the effects of junk-food on the PFC.

Investigating Unknown Regions of *E. coli* Metabolism

John Peterson
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This research was supported by the National Science Foundation under grant No. MCB-1330734.

Metabolic models are useful for a number of applications in the world of biology. If one understands the biochemistry involved in every part of an organism, it could be possible to predict how the organism would behave at the molecular level in particular environments. Once one model is understood sufficiently, the concepts could be applied to other organisms and groups of organisms. This has possible applications in medicine and environmental science concerning microbiomes. The base model could also be used as a foundation for further experimentation and metabolic modeling projects on more complex or less understood organisms. Our work focuses on the state-of-the-art metabolic model for *E. coli*, since this is a well studied model organism. However, the model currently only accounts for conservation of mass and the presence of pathways connecting metabolites. In order to be more useful, the model would have to incorporate a number of biological patterns. One such pattern is transcriptomics: the analysis of gene expression over the entire genome when the organism is in different environments. Transcriptomics is of particular interest as it involves, to some degree, all parts of the metabolic network. However, the usefulness of these data depend upon the diversity of the experiment pool. The current transcriptomic data set for *E. coli* contains about 1200 experiments, representing fewer than 100 unique conditions. We have conducted initial algorithmic development and analysis to identify parts of the metabolic network not yet perturbed in transcriptomic data. The goal of this project is to design a set of unique conditions and gather expression data. These data will be used to improve upon the initial algorithms and to eventually supplement the transcriptome data set with enough information to improve the current computer model of *E. coli* K12.

Wildlife Use Patterns in a Constructed Wetland

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This research was supported by the Outdoor Discovery Center/Macatawa Greenway and the Department of Biology at Hope College.

Wetland habitats fill vital environmental roles because they typically enhance wildlife diversity and perform important ecosystem services. The Outdoor Discovery Center/ Macatawa Greenway in Holland, MI began construction of a wetland from an agricultural field in the summer of 2015, hoping to trap sediments that otherwise travel downstream to Lake Macatawa while restoring wildlife populations. However, this site is near Tulip City Regional Airport, which raises concerns for increased aviation collisions with wildlife. Our study investigates the potential wildlife hazard to aviation and explores ecological questions regarding transitional changes of wildlife use of different habitats. We measured wildlife activity and abundance as well as vegetation structure at the constructed wetland and at nearby wet meadow, open water, and airport habitats. Compared to previous agricultural land use, the new wetland has shown a substantial increase in vegetation structural diversity and wildlife species diversity. Seasonal migrations dominate changes in wildlife abundance, activity, and aviation threat in each habitat type. Results thus far suggest no consistently increased hazard to aviation even though wildlife has flourished in the new wetland.





Genomic Analyses of the Novel Mycobacteriophage KashFlow

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*This research was supported
 by the Howard Hughes
 Medical Institute
 SEA-PHAGES Program.*

Eighteen new mycobacteriophages were isolated from soil samples collected around the state of Michigan and parts of the United States. All phages were capable of infecting *Mycobacterium smegmatis* and were isolated through either enrichment or direct plating at 32°C or 37°C. A variety of plaque morphologies were produced based on size, shape, and clarity; both lytic and temperate phages appear represented in this collection. The mycobacteriophage, KashFlow, was chosen as one of three phages for complete genome sequencing and comparative genomic analyses. The predominant plaque produced by KashFlow at 37°C was circular and 2 mm in diameter. The complete genome sequence for KashFlow revealed relationships to members of the Cluster J, which contains 30 sequenced members to date. The genome of KashFlow is 111.6 Kb, 60.2% GC, and contains 243 genes, including 2 tRNA^(Lys-TTT) genes. Upon initial analysis, KashFlow shares a number of gene products with several other phages belonging to the J cluster. In a majority of these instances, these gene products are nearly identical to one another and are almost always perfectly aligned. This trend is predicted to continue throughout the entirety of the KashFlow genome as a number of cluster J phages share these same attributes. A detailed analysis of the complete genome sequences and comparison with sequenced mycobacteriophages is the subject of the second semester of this yearlong course and is presented.

Genomic Analyses of the Novel Mycobacteriophage Settecandela

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*This research was supported
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SEA-PHAGES Program.*

Eighteen new mycobacteriophages were isolated from soil samples collected around the state of Michigan and parts of the United States. All phages were capable of infecting *Mycobacterium smegmatis* and were isolated through either enrichment or direct plating at 32°C or 37°C. A variety of plaque morphologies were produced based on size, shape, and clarity; both lytic and temperate phages appear represented in this collection. The mycobacteriophage, Settecandela, was chosen as one of three phages for complete genome sequencing and comparative genomic analyses. The predominant plaque produced by Settecandela at 37°C was 1 mm in diameter, and took 48 hours to appear. The complete genome sequence for Settecandela revealed a relationship to the singleton, Phrappuccino, discovered by the Hope College phage class in 2016. The genome of Settecandela is 145.2 Kb, 67.4% GC, and contains 224 genes. The close relationship with Phrappuccino necessitates the formation of a new cluster of mycobacteriophages, Cluster AA. The two genomes are identical over much of their length, with the exception of an approximately 9000 bp region in Settecandela containing 25 genes. There is strong evidence at the morphological (Myoviridae) and genomic levels for a relationship to Cluster C phages. Despite this relationship, Cluster AA genomes do not carry any tRNA genes. A detailed analysis of the complete genome sequences and comparison with sequenced mycobacteriophages is the subject of the second semester of this yearlong course and is presented.

Genomic and Physiological Characteristics of Novel *Escherichia* Strains Isolated from Freshwater Sources

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Luke Ragon
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This research was supported by the National Science Foundation under grant No. MCB-11616737 and the Herbert H. and Grace A. Dow Foundation.

Escherichia coli is primarily viewed as a commensal of the mammalian gut, but this view is changing with the recognition of “naturalized” populations of *Escherichia* found in non-host associated, secondary environments. The majority of *Escherichia* genome sequences comes from studies of host-associated isolates. While these strains are important to health and agriculture, they do not adequately address the potential diversity of strains found in secondary environments (e.g., freshwater streams and lakes, beach sands, soils). These sources may serve as reservoirs in which diverse strains of *Escherichia* exchange genetic information. We produced genome sequences of *Escherichia* isolates from freshwater sources as part of a longitudinal survey of microbial communities in Lake Macatawa Watershed. Relationships of isolates with publicly available sequenced *Escherichia* strains were determined using core genome phylogenetic inference. Approximately 98% of watershed strains are related to traditional *E. coli*; 2% of strains are related to non-traditional environmental clades. Members of Phylogroup B1, often isolated from freshwater environments in previous studies, make up 46% of the strains within the *E. coli* lineage. We used *in silico* methods to screen watershed strains for antibiotic resistance genes and virulence factors. Most watershed strains contain ≤ 30 antibiotic resistance genes, consistent with strains isolated from host sources, but more than the number of genes found within the non-traditional environmental clades. We conducted comparisons to determine protein families that distinguish among watershed isolates and reference *Escherichia* strains within established phylogroups. While there are protein families that clearly distinguish between different phylogroups, few differences were observed between watershed and related reference *E. coli* strains. Physiological experiments testing metabolic activity of watershed strains at 2-11°C revealed that many metabolize glucose at 8°C. These data expand our knowledge of potentially naturalized *E. coli* strains, allowing better water quality monitoring techniques that quantify *E. coli* as fecal indicator bacteria.

Global Survey of Water Quality Using Point-of-Use Water Filters

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*This research was supported
 by Sawyer Products, Inc.*

Waterborne illnesses continue to be a major global health concern. A leading strategy for providing clean drinking-water is the use of point-of-use water filters. Sawyer Products, Inc., a privately owned outdoor product company, launched Sawyer International to bring 0.1 micron hollow fiber membrane filters to people in need of safe, clean drinking-water. These filters remove harmful bacteria, protozoa, and cysts like *Escherichia coli*, *Salmonella typhi*, *Vibrio cholerae*, and *Giardia*. Additionally, Sawyer is providing polyurethane foam filters designed to remove metals known to be harmful in excess concentrations, including arsenic and cadmium. Hope College, in collaboration with Sawyer, is conducting a global water quality survey that will study drinking water sources from over 30 countries. We have partnered with NGO's to deliver water filter kits to sites, collect and process water samples in the field, and return the filters to Hope College for analysis of microbial populations, classes of antibiotics, and chemicals found in the water. In addition, we will conduct an in-depth study of the introduction of filters to all households in 20 villages in Fiji. Samples will be obtained from 2 water sources per village in order to assess water quality and effective removal of potential pathogens from the water sources; surveys to assess the health status of members of the villages will be administered. Two more visits will be made to villages at 2-4 weeks and 8 weeks post filter introduction to obtain additional water samples and survey data. We anticipate that introduction of filters into villages without access to clean water will improve the health of residents. The data obtained will allow us to describe biological and chemical properties of global water sources that have adverse effects on the health and wellbeing of residents and give evidence for the efficacy of point of use water filters.

Student Autonomy in a Nontraditional Middle School Classroom: How Do Students Handle Freedom?

This project was an interdisciplinary endeavor between the Department of Biology and the Department of Education. See page 97 in the education section of this book for full abstract.

Genetics, Gender, Gratitude

This project was an interdisciplinary endeavor between the Department of Biology and the Department of Psychology. See page 124 in the psychology section of this book for full abstract.

Synthesis of Ortho-Substituted Benzamides through Decarbonylative Cross-Coupling of Phthalimides

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Dr. Jeffrey Johnson,
Chemistry

The development of nickel-mediated catalysis has progressed to the decarbonylation of phthalimides for cross-coupling with boronic acids to form ortho-substituted benzamides. The variables of the reaction are being manipulated to determine if the nickel can be used catalytically rather than stoichiometrically. In addition, many reactions produce a byproduct in which a carbon-hydrogen bond forms in the desired position of the boronic acid substituent, making isolation of the ortho-substituted benzamide through column chromatography difficult. The source of this byproduct—the reduction product—is still under investigation as the scope and isolation of the product is expanded.

Investigating the Potential of the HKUST-1 Metal- Organic Framework for Ammonia Adsorption

Landon Brower
Brandon Bowser

Mentor:

Dr. Mary Elizabeth
Anderson,
Chemistry

This research explores the ammonia adsorption capabilities specific to three variations of the HKUST-1 metal-organic framework (MOF) system: bulk powders, drop-cast films, and surface-anchored thin films. Samples were synthesized, characterized, and exposed to pure ammonia gas in an effort to gain a deeper understanding of how the framework responds when exposed to harmful gas molecules. Literature has shown that the as-synthesized HKUST-1 system contains water molecules coordinated to the axial positions of the copper-carboxylic acid paddlewheel structure. Further research described herein has uncovered the presence of not only water molecules, but also other solvent molecules. Paddlewheel adsorbates alter the interaction of the ammonia gas with the framework, resulting in significant morphological change. The activation of the framework, or the removal the guest molecules via heat, has been shown to prevent the drastic change in morphology. Fourier-transform infrared spectroscopy, scanning electron microscopy, scanning probe microscopy, and powder x-ray diffraction were used to characterize samples before and after ammonia exposure, tracking uptake of ammonia, as well as monitoring changes in both morphology and crystal structure. Future work will investigate different potentially harmful gases and additional MOF systems.

This research was supported by the Hope College Chemistry Department, National Science Foundation under grant No. CHE-1508244, and the American Chemical Society Petroleum Research Fund.

Developing Monovalent Ion Parameters for the Optimal Point Charge (OPC) Water Model

**Daniel Clark
John Dood**

Mentor:

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Chemistry

This material is based upon work supported by the NSF-MRI under grant No. CHE-1039925 and NSF-RUI under grant No. CHE-1058981.

Molecular dynamics (MD) simulations are used to model the structure and movement of macromolecules. The gold standard for MD is to explicitly include water molecules using one of several standard models. Recently, a new water model, Optimal Point Charge (OPC), has been developed with simulation performance that compares better to experiment than existing models in its class (Izadi, Anandakrishnan, Onufriev, *J. Phys. Chem. Lett.*, 2014, 5, 3863-3871). For this new water model to be useful, Lennard-Jones (LJ) parameters must be developed for at least a few monovalent ions. In this study MD simulations were used to develop these parameters. Preliminary results are presented including: extensive convergence testing of Hydration Free Energy, Lattice Constants (LC), and first peak position of radial distribution functions (RDF's); as well as surfaces showing the dependence of the RDF and LC on various LJ parameters within the OPC water model.

Development and Optimization of Amperometric Glucose Biosensors Based on Glucose Oxidase and Tris [5-amino-1,10-phenanthroline] Iron(II) Polymer Films

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Mentor:

Dr. Kenneth Brown,
Chemistry

Glucose biosensors are typically used for detecting blood glucose levels in diabetics. These sensors electrochemically detect glucose through a specific mechanism that involves biochemical and physical transducers. A method to form the enzyme layer onto the physical transducer was optimized. Electrochemical behavior of Iron(II)-5-amino-1, 10-phenanthroline [Fe (Phen NH₂)] polymer films was investigated as a redox mediator in a glucose biosensor. The biosensors gave the largest response in the pH range of 7-8. Interferences including ascorbic acid and lactic acid did not give a false positive response. There was no significant difference between the detection of glucose using a biosensor stored at room temperature versus one stored at 4°C. Both films lasted 20 days. The detection limit of the biosensors was found to be 0.30 mM which corresponds to a signal to noise ratio of 3:1.

Rhodium-Catalyzed Carbon-Carbon Bond Activation and Functionalization Using Imine Reactions

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Mentor:

Dr. Jeffrey Johnson,
Chemistry

This research was supported by the National Science Foundation under grant No. CHE-1148719.

The activation and functionalization of carbon-carbon single bonds has proven difficult to achieve using traditional organic methods. Previous Johnson Lab projects have explored the use of rhodium catalysts to permit the selective activation and functionalization of carbon-carbon bonds in ketones. However, these reactions have required a nearby nitrogen atom, presumably to coordinate with the rhodium. Herein, we explore a new type of reaction in which the coordinating nitrogen is provided by reversible imine formation from a ketone and a primary amine. Efforts towards making this reaction more generalizable are currently underway.

Validation of a Novel Transition Frequency Eigenanalysis Approach in the Analysis of Eye-Tracking Data for Understanding Viewing Patterns of Multiple Representations

Richard Edwards
Gracie Lewellyn

Mentor:

Dr. Justin Shorb,
Chemistry

Michigan Space Grant Consortium

Eye-tracking has been increasingly used in educational research in order to gain insight into how we interpret information. Current analysis methods are limited in that they solely interrogate fixations or transitions, with the latter limited to only two areas on a page. In order to understand more complex gaze patterns, it is necessary to be able to quantify dominant viewing behaviors that couple three or more fixation areas. A novel approach to analyzing eye-tracking data will be discussed along with sample data that highlight differences in viewing patterns between different readers. This analysis is done using eigenvalue/eigenvector decomposition, which is the base algorithm found in Factor Analysis and Principal Component Analysis. In our group, we are interested in using this analysis method to understand an individual's comprehension of the complexity in chemistry representations. Making use of the triplet relationship, we would be able to replicate the expert/novice study conducted by Kozma and Russell in 1997 by observing the variations in attention which a person gives several representations to differentiate between experts and novices.

Utilizing a Home-Built Confocal Fluorescence Microscope to Study Neuroregeneration

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Christopher Davis
Andrew Cutshall
Sarah Jernigan
Timothy Hoffman
Derek Summers
Arcelia Ortega

Mentor:

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Chemistry

This research was supported by the National Science Foundation under grants No. NSF-MRI #1335890, NSF-REU #1263097, and NSF-RUI #1058981.

Spinal cord injuries affect approximately 282,000 people within the United States alone (National Spinal Cord Injury Statistical Center, Facts and Figures at a Glance. Birmingham, AL: University of Alabama at Birmingham, 2016). Studying neuroregeneration in vertebrates such as zebrafish, to understand the mechanism behind this process, may allow us to apply the concept to humans and assist in recovery from spinal cord injuries. A home-built confocal fluorescence microscope will be used for both live cell imaging and laser ablation. Laser ablation is a technique that will allow us to non-invasively induce the neuroregenerative process by causing individual neurons to undergo apoptosis. Results from a variety of calibration samples and preliminary zebrafish imaging are shown comparing our home-built confocal microscope with a commercial confocal microscope as a standard.



Long Wavelength Azo Dye Monomers for Photomechanical Applications

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Mentor:

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This work has been supported by The Camille & Henry Dreyfus Foundation (Dreyfus Teacher-Scholar Award), the Michigan Space Grant Consortium (undergraduate fellowship program and faculty seed grant), the Schaap Research Fellows program, and the Hope College Chemistry Department.

Azo dyes have long been incorporated into photomechanical systems with promise as wireless actuators (White, T.J.; Broer, D.J. *Nat. Mater.* 2015, 14, 1087-1098). Most azo dyes photoisomerize in the ultraviolet to blue-green region of the electromagnetic spectrum. However, these high energy wavelengths are prone to competitive absorption by other components of photomechanical devices, and are correlated to high levels of photodegradation of the material. These wavelengths also limit any biomedical applications, as they are incompatible with human tissue.

Recently, Aprahamian and coworkers published a series of BF₂-coordinated azo dyes which photoisomerize in the red-orange (Yang, Y.; Hughes, P.; Aprahamian, I. *J. Am. Chem. Soc.* 2012, 134, 15221-15224) to near-infrared (Yang, Y.; Hughes, P.; Aprahamian, I. *J. Am. Chem. Soc.* 2014, 136, 13190-13193) region of the spectrum. At these wavelengths, competitive absorption and photodegradation are minimal, as is absorption by mammalian tissue. In the Gillmore organic photochemistry research group, we are preparing analogs of Aprahamian's dyes with polymerizable "handles" which may be incorporated into photomechanical polymers. These polymers will be prepared and studied in collaboration with the materials science / mechanical engineering research group of Professor Matt Smith in the Hope College Engineering Department. Synthetic efforts to date and future plans for this nascent research collaboration are described in this poster.

Modified Polyol Synthesis of Tetrahedrite ($\text{Cu}_{12}\text{Sb}_4\text{S}_{13}$)

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Synthesizing thermoelectric materials by low-cost, low-energy methods can potentially alleviate the current energy crisis because of the ability of these materials to convert waste heat into electrical current. While most thermoelectric materials contain rare earth metals, tetrahedrite is composed of earth-abundant elements and exhibits high performing thermoelectric properties due to a low thermal conductivity from its complex unit cell. A solution phase, solid-state synthesis technique known as the modified polyol process was used to synthesize pure tetrahedrite nanoparticles. These nanoparticles were characterized by powder x-ray diffractometry, scanning electron microscopy, and energy dispersive x-ray spectroscopy. Thermopower, electrical resistivity and thermal conductivity measurements were taken for this material to determine the maximum figure of merit (ZT) values, which describes the efficiency of the energy conversion. The values found for our materials were on par with or exceed those of tetrahedrite fabricated by conventional high energy and time consuming processes. Cu sites can be doped with Zn to improve efficiency and the reaction was scaled up to produce over 2 grams of material, which enabled the thermoelectric characterization of nanomaterials from a single batch reaction.

The Validation of Eye-Tracking Behaviors of Experts and Novices While Viewing Multiple Representations of Chemistry Concepts

Gracie Lewellyn
Richard Edwards

Mentor:

Dr. Justin M. Shorb,
Chemistry

Education research has often interrogated the differences in mental schema between Experts and Novices in a particular discipline. These mental schema, or organizations of ideas and thoughts within a person's brain, can give insight into which connections are essential for complete understanding of a field of study. For instance, in chemistry, it has been found that experts more readily connect chemical concepts visualized in macroscopic, symbolic, and sub-microscopic representations. This triplet relationship has been studied repeatedly in the literature, but requires active think-aloud studies or a series of tests which involve a certain extent of non-natural activity. Eye-tracking has been increasingly used in educational research in order to gain insight into how we interpret information in a passive observational manner. Making use of the triplet relationship, an experiment has been conducted to replicate the expert/novice study conducted by Kozma and Russell in 1997 by using eye-tracking while having participants perform a sorting task. Similar results for the sorting task will validate the interpretation of the eye-tracking analysis methods for future use.

PIGE Analysis of Food Contact Papers and Fabrics Containing PFAS

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This research was supported by the National Science Foundation Research at Undergraduate Institutions program (PHY-1306074).

Per- and polyfluoroalkyl substances (PFASs) are chemical compounds used as powerful, long-lived surfactants in many consumer products. These fluorochemicals are present in stain-resistant and waterproof carpets, fabrics and papers. PFAS coatings have become an area of public concern due to their environmental persistence, ability to bioaccumulate, and suspected human toxicity. A variety of tests have been conducted in order to better understand the relationship between these PFAS coatings and consumer products. PFAS migration studies have been conducted in order to examine the mobility of PFASs in contact with food simulants and condiments. Water contact angle measurements have been obtained on food contact papers to show the relationship between the fluorine concentration and the properties of water on the hydrophobic PFAS coated papers. Additionally, calibration curves of paper and fabric standards have been created in order to convert the fluorine concentrations, determined by PIGE analysis, given in counts of gamma rays per microcoulomb into units of nanograms of fluorine per centimeter squared.

Emerging Ruthenium-Glucose Complexes with Chemotherapeutic Potential and Inquiry into the Biochemical Mechanism of Action

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Mentors:

Dr. Amanda Eckermann,
Chemistry

Dr. Kristin Dittenhafer-Reed,
Chemistry

Due to the severe toxicity of anticancer platinum complexes and acquired drug resistance, research has focused on arene ruthenium complexes as viable alternatives. Arene complexes of the formula $[\text{areneRu}(\mu_2\text{-L})\text{Cl}]_2$ and $(\text{areneRu})_2(\mu_2\text{-L})_3^+$ (L = alkyl thiolate) are known to be cytotoxic with IC_{50} values in the micromolar and submicromolar ranges, respectively. Our goals are to investigate whether glucose ligands or hydrophobic ligands on cymene ruthenium complexes improve specificity for cancerous cells over normal cells. Reaction of the sodium salt of β -D-thioglucose with $[\text{cymeneCl}_2\text{Ru}]_2$ forms $[(\text{cymeneRu}(\mu_2\text{-thioglucose})\text{Cl})_2]$ (1) and $(\text{cymeneRu})_2(\mu_2\text{-thioglucose})_3^+$ (2). These compounds were successfully purified by HPLC and characterized by NMR spectroscopy. Toxicity of 1 has been investigated in vitro. Half-sandwich arene ruthenium complexes with hydrophobic N-heterocyclic ligands of the formula $(\text{arene})\text{Ru}(\text{L})\text{Cl}_2$ have been synthesized where L = 4-phenyl pyridine, isoquinoline, benzimidazole, and CF_3 , and have been investigated and characterized spectroscopically.

Carbon-Carbon Single Bond Activation Used for Coupling with Michael Acceptors

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by the National Science
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Carbon-carbon single bond activation and functionalization occurs in a quinolinyl ketone structure through rhodium catalyzed bond activation and subsequent insertion of a Michael acceptor, primarily methyl acrylate and N,N-dimethylacrylamide. A variety of quinolinyl ketones and Michael acceptors are observed to react catalytically, forming a disubstituted alkene coupling product. A broad scope of quinolinyl ketones and Michael acceptors have been used to investigate the mechanism for the reaction.

Evaluation and Revision of the General Chemistry Lab Curriculum

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Mentor:

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*This research was supported
by the Hope College
Chemistry Department.*

An effective General Chemistry Laboratory experience emphasizes inquiry-based learning, reliable data, and connections to current chemistry research. Hope College seeks to constantly improve our curriculum to help students learn more effectively. To do this, an evaluation tool for Hope College's General Chemistry Lab curriculum was created to guide lab development. In this project, we evaluated the current General Chemistry Lab curriculum and proposed revised labs that will fill in evaluation gaps. We will explain the method of evaluation, describe a new lab structure based on the Science Writing Heuristic, and outline experimental updates made to the curriculum. Besides being more comprehensive, the labs will also introduce students to faculty research. We hope to implement labs which will interest students in furthering their education through research and encourage students to ask questions using inquiry-based curricula. This is the first evidence in the literature for using current faculty research as a theme for a first-year laboratory.

Identifying the Expression Patterns of xCT in Zebrafish to Determine Its Role in Neuroregeneration

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Kevin Franz
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Mentors:

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Dr. Leah Chase,
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This research was supported by the National Science Foundation under Grant Nos. RUI-0843564, RUI-1058981, MRI-1335890, and REU-1263097. This research was also supported by the Herbert H. and Grace A. Dow Foundation.

System x_c^- is a heterodimeric amino acid transporter comprised of a transmembrane light chain unit, xCT, and an extracellular heavy chain unit, 4F2HC. System x_c^- has been shown to exchange intracellular glutamate for extracellular cystine, which is then reduced within the cell to cysteine, the limiting reagent for glutathione production. Glutathione is a reducing agent that is important in reducing oxidative stress, which untreated can trigger cell death due to the oxidation of DNA, RNA, and proteins. It has been shown that the protein xCT is strongly expressed in the central nervous system, particularly in neuroprotective cells such as astrocytes and microglia. It is believed that reduction of oxidative stress in the environment of neurons and neuroprotective cells is critical to allow new neurons to be produced in processes such as neuroregeneration. The current focus of the study is to qualitatively determine the expression patterns of the xCT gene in zebrafish embryos using in situ hybridization. This will allow us to later identify the role that xCT plays in neuroregeneration in vivo.



$\text{Cu}_3(\text{BTB})_2$: Multilayer, MOF, or Hybrid?

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Chemistry

This research was supported by the Hope College Chemistry Department, American Chemical Society Petroleum Research Fund, and the National Science Foundation Grant No. CHE-1508244.

Metal organic frameworks (MOF) are highly porous crystalline structures that are most commonly studied in the powder form. However, they may also be studied as surface anchored MOFs (surMOF). The growth mechanism of the iconic MOF-14 system has been studied extensively as a surMOF using atomic force microscopy and ellipsometry, which indicate a Van der Merwe growth mechanism. Given this growth mechanism and the unit structure of MOF-14 as a powder, it is of interest to determine if the surMOF-14 has a multilayer structure, framework structure, or a hybrid structure. To investigate the structure, the growth mechanisms of the system on different self-assembled monolayers (SAMs) was studied. In addition, ammonia exposure was conducted to determine if the MOF-14 system behaves similarly to either the MHDA multilayer system or the HKUST-1 surMOF. Results indicate that changing the SAM does not have a major effect on changing the growth mechanism of surMOF-14. Preliminary results indicate the surMOF-14 does not respond in a way similar to that of the MHDA multilayer system or the HKUST-1 surMOF.

Computational Chemistry in the Cloud

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Mentor:

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This research was supported by the Arnold and Mabel Beckman Foundation.

The compute cloud (Infrastructure as a Service) abstracts computer hardware into virtual machines hosted by companies such as Google and Amazon. Advantages of using the compute cloud include flexible choice of computer architecture, no hardware maintenance, paying only for services used, and better reliability. Significant cost savings can be achieved in many circumstances.

The project Server in the Cloud (SITC) was developed to adapt the compute cloud to computational chemistry. SITC is a set of scripts that installs a fully functional computational chemistry webserver to a cloud computer. The webserver is composed of Apache, WebMO, and some combination of computational chemistry engines. A single computational chemistry webserver, however, is not powerful enough to service a realistic number of users. To address this issue, the project Grid in the Cloud (GITC) was developed. GITC is a job scheduler that takes advantage of the cloud environment by spawning new cloud instances to complete jobs.

Exchange Kinetics of Quinoliny Ketones with Boronic Acids via Rhodium Catalyzed C-C Bond Activation

Eric Weeda
Stanna Dorn

Mentor:

Dr. Jeffrey B. Johnson,
Chemistry

Carbon-carbon σ bond activation is difficult due to the strength of the σ bond and the steric hindrance around the bond. Using a quinoliny ketone system, activation can be achieved with a rhodium catalyst, allowing not only carbon-carbon σ bond activation, but also functionalization using boronic acids. The exchange of aryl substituents between quinoliny ketones and boronic acids, proceeding through carbon-carbon σ bond activation, is the subject of a kinetic study. NMR and kinetic studies are used to determine the rate law of the reaction using ortho-fluoro quinoliny ketone and 4-trifluoromethyl boronic acid. In addition, NMR studies are used to compare the rates of various aryl substituents of both boronic acids and quinoliny ketones to ortho-fluoro quinoliny ketone and 4-trifluoromethyl boronic acid exchange.

Validation of Theoretical IR Spectroscopic Methods for Protein Structure Determination

Yong Chul Yoon

Mentor:

Dr. Justin Shorb,
Chemistry

This research supported by the John and Eleanor Dwyer Fund for Summer Research in Chemistry

Determination of the protein structure has become an increasingly important task for many scientists and pharmacists as the structure of a protein determines its function. For instance, many of the debilitating effects of genetic diseases are caused by the misfolding of proteins. Scientists have developed many different methods, such as X-ray crystallography and NMR, to characterize the structure of proteins. A more recent development in protein characterization involves the use of IR spectroscopy because we are able to capture the motion of proteins at physiological pH, and use isotope labeling to identify individual peptide linkages, which we cannot with other methods. Various groups have used theoretical models to create empirical mappings from molecular dynamic simulation to assist interpreting these IR spectra, but often use a limited set of model systems to parameterize their map. Here, we reveal a creation of a library of di- and tri-peptides that are prevalently present in biological systems. This library of IR spectra can be used to validate current empirical mappings and be a resource for improving current models.

Model Polymer System for Red Light Activated Azobenzene Molecule

This project was an interdisciplinary endeavor between the Department of Engineering and the Department of Chemistry. See page 61 in the engineering section of this book for full abstract.

The JanDY Survey System

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JanDY is a survey system built by students and faculty from Hope College's Computer Science Department. It is the program that runs behind the scenes during the Student Assessment of Learning & Teaching surveys that all students take each semester, which are used by the institution and instructors to evaluate the effectiveness of all courses at Hope. The current system was built using the outdated Google Web Toolkit. Our goal was to build a new version of JanDY using a more modern web framework, AngularJS. Beyond updating the technologies used in the system, we also added new functionality, including an interface for the creation and editing of surveys. In order to ensure that our new system was reliable we constructed a comprehensive test suite in the development process, testing our web application and load handling with tools such as Mockito, Jasmine, Karma, and JMeter.

Developing an iOS App for Educational Budgeting

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Joanie Davis
Meredith Lind

Mentor:

Dr. Mike Jipping,
Computer Science

Our team spent ten weeks developing an iPhone app, called Bilancio, that helps teach and practice budgeting skills for the Ready for Life program, which prepares students with cognitive, social or learning disabilities for a life of independence. Focusing on usability, we strove to make a simple, intuitive app, tailored to the needs of teachers and students at Ready for Life. The development process included learning Apple's programming language, Swift, and using industry standard version control, communication and project management tools. By the end of the summer, we had created a unique product that would benefit the lives of its users.

Environmental Noise Monitoring Using a Wireless Sensor Network

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Mentor:

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Engineering

This work was supported by the Jacob E. Nyenhuis Grant for student and faculty collaborative research.

Environmental noise monitoring is quickly increasing in relevance due to urbanization and this increase can have negative impacts on human productiveness. However, certain measures can be taken to negate the noise. The Jack H. Miller Center for Musical Arts on the campus of Hope College was built with noise cancellation purposes in mind due to the building's close proximity to railroad tracks. The purpose of this research was to develop a network of wireless sensors capable of measuring the noise levels both outside and inside of the Jack H. Miller Center in order to validate the effectiveness of the noise cancellation features of the building. Toward this end, a Sparkfun Sound Detector board was chosen as a prototype transducer for measuring audio signals, and it was calibrated in the Jack H. Miller Center to establish a baseline for a conversion from Analog-to-Digital Converter readings to decibel units. Simultaneously, a wireless sensor node that will be eventually adopted for noise monitoring was updated to make the data acquisition process more reliable and the overall network of sensors more robust. The wireless sensor network was modified to handle heavier wireless traffic and to transfer data acquisition control to a single board computer (SBC) rather than user input. Network tests were performed, which showed the network to be functional. The next steps in this research are to interface the sound detector board with the wireless sensor node such that it can sample at a frequency of at least 12 kHz, as well as communicate across an existing existing wireless sensor network.

Modeling Surface Electrical Stimulation

Kate Finn
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Mentor:

Dr. Katharine Polasek,
Engineering

This research was supported by the Hope College Dean Start Up Fund, Hope College Department of Engineering, the Michigan Space Grant Consortium, and the Howard Hughes Medical Institute.

Surface electrical stimulation is a non-invasive method for interfacing with the nervous system. However, variations in electrode placement, limb position and an individual's anatomy make the results difficult to replicate, even in the same person. This project developed and validated a model to allow systematic varying of these key parameters to assess their contribution to nerve activation. The objective of this research in the future is to use the model to develop a surface electrical stimulation system that allows for precise nerve activation.

A three-dimensional finite element model of the elbow was created, using two illustrated cross sections of the arm swept together and extruded in both directions. Three versions of the median nerve were modeled with 10 fascicles in random arrangements and 250 axons per fascicle. The fascicle diameters and distribution of axon diameters were based on measurements of a human median nerve at the elbow. Parameters were adjusted to reflect the differences in channel properties between motor and sensory axons; fifteen percent of the axons had motor properties and the remaining axons had sensory properties. Simulations were run, applying a voltage across two electrodes placed on the skin. The threshold voltages predicted by the model were consistent with experimental results from human subjects. In addition, the model predicted 20% activation of sensory axons before any motor axons, in the same way that sensory perception occurred before muscle movement experimentally. Using an ANOVA analysis, it was found that voltage, axon diameter, axon type, and fascicle location were all significant predictors of percent activation. The model has been validated with experimental results from human subjects. Next, the model will be used to analyze differences in nerve activation for different electrode arrangements and an algorithm will be developed to adjust and optimize nerve activation for various individuals.

Modeling Motor and Sensory Axons

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Kate Finn

Mentor:

Dr. Katharine Polasek,
Engineering

This research was supported by the Michigan Space Grant Consortium and the Howard Hughes Medical Institute.

Surface electrical stimulation of the median nerve at the elbow can be used to elicit a sensation in the hand or fingers. However, perception of the stimulus can be strongly dependent on precise electrode placement. A model was needed to predict the ideal size and placement of electrodes to control activation of the nerve. To accurately predict activation of sensory and motor axons, a separate model for each axon type was required. The existing full axon model developed by McIntyre, Richardson, and Grill (2002) was created using the properties of a motor axon, but did not focus on the differences between motor and sensory axons. Previous work by this research team noted that sensation could be achieved at a lower stimulation voltage than movement. It was hypothesized that sensory axons would have a lower threshold voltage of activation than motor axons due to the differences in the properties of the membrane.

The MRG (2002) model of a motor axon was modified to reflect the membrane properties of a sensory axon using motor-sensory comparisons found in literature. Both the motor and sensory models now include fast potassium channels and hyperpolarization-activated cyclic nucleotide-gated (HCN) channels. The parameters with the largest effect on threshold were found to be the conductance values of the fast sodium channel, HCN channels, and leak. The model results compare well with experimental measurements for conduction velocity, strength duration curves, and action potential shapes found in the literature. For a given fiber diameter, the sensory axon model predicted activation at a lower stimulation voltage than the motor axon model, similar to experimental results.

The validated models can be used to predict activation of sensory and motor neurons in applications such as sensory feedback from prosthetics and treatment to increase neuroplasticity in patients after spinal cord injury, stroke, or amputation.

Model Polymer System for Red Light Activated Azobenzene Molecules

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Mentors:

Dr. Matthew Smith,
Engineering

Dr. Jason Gilmore,
Chemistry

Photomechanical materials are light responsive substances that can be repeatedly and wirelessly actuated. These materials have potential for applications such as soft actuators in microfluidic or biomedical devices. Previous studies have observed macroscopic deformation in polymers by varying location, polarization, wavelength, and intensity of light on polymers containing the light sensitive molecule, azobenzene. While past work in this area has been beneficial, azobenzenes are typically only triggered when exposed to UV or blue-green light. These wavelengths of light are harmful to biological tissue and degrade polymers after long periods of exposure. This study's objective was to create a polymer system in which a red or NIR activated azobenzene could be incorporated. Multiple model systems were created with methyl methacrylate, butyl acrylate, and styrene as monomers, while standard off-the-shelf azobenzenes were used to create the photomechanical response. Results indicate that it is possible to cause the polymer film to move either towards or away from a blue-green light source ($\lambda = 450\text{nm}$). Further testing must be done in order to determine if the response is caused by light actuation or thermal actuation. In the future, studies will also be conducted to generate a more consistent photoresponsive film for integrating red/NIR absorbing azobenzenes.

Surface Stimulation as a Potential Treatment for Phantom Limb Pain

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Mentor:

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Engineering

This work was supported by the Jacob E. Nyenhuis Grant for student and faculty collaborative research and the Christine Tempas Engineering Summer Research Fund.

Phantom Limb Pain, a pain or discomfort in the missing limb, is experienced by the majority of amputees. We hypothesize that by eliciting a non-painful sensation in the missing limb, phantom limb pain may be reduced or eliminated. The overall goal of this project is to develop a therapy that consists of an electrically activated tapping sensation in the missing hand or foot combined with a robot tapping on the prosthesis. The goal of this project was to compare the electrically activated sensation with actual touch.

The median or ulnar nerve was stimulated with the goal of creating a realistic tapping sensation in the subject's hand and the common peroneal nerve was stimulated with the goal of eliciting sensation in the foot. The rubber hand and foot illusions were then used to quantify the authenticity of the stimulated sensation. A variety of rubber hand/foot illusion conditions were performed on each subject: three traditional trials where a human investigator tapped on both the real hand and the rubber hand and one artificial trial where surface electrical stimulation evoked a tapping sensation in the real limb while the robot tapped on the rubber limb. The results of the traditional and artificial methods were compared to determine if a significant difference was present. Data collected included: questionnaire results, proprioceptive drift, and temperature changes of the arm/leg. A total of twenty five rubber hand illusion trials were completed. Results demonstrate that both physical touch and artificial sensations were able to evoke a more realistic illusion than the control condition. However, sensations evoked by electrical stimulation were not as realistic as those produced by physical touch. The rubber foot illusion trials are still ongoing, but preliminary analysis shows that results are trending towards a positive illusion for both traditional and artificial conditions.

Bio-Inspired Control of Civil Infrastructure

Anne O'Donnell

Mentor:

Dr. Courtney Peckens,
Engineering

This research was supported and funded by the Hope College Engineering Department and the Hope College Dean Start Up Fund.

Civil infrastructure is constantly at risk for failure due to unpredictable high impact loadings such as earthquakes and high winds. Over the course of the last decade, a bio-inspired wireless sensor node has been developed for the purpose of more effective structural monitoring and control. This node draws inspiration in its functionality from the mammalian cochlea found in the inner ear and benefits of the node include its real time frequency decomposition capabilities as well as its ability to compress high amounts of data. In this study, a bio-inspired control algorithm, which draws inspiration from the mechanisms employed the biological central nervous system for sensing and control, was applied to a single story structure in order to produce more effective methods of control. Specifically, the structure's performance when subject to control was simulated using Newmark's method and the effectiveness of the control was quantified. It was determined that this algorithm produced effective displacement control by reducing the maximum displacement of the single story structure by 42.90%, as well as reducing the normalized displacement over the entire time period by 32.33%.

Development and Study of Printable Stimuli-Responsive Model Polymer Systems

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This research was supported and funded by the Hope College Engineering Department and the Hope College Dean Start Up Fund.

The study of stimuli-responsive materials that act as transducers, converting one form of energy to another, has become a significant topic of research over the past several decades. For example, some polymers functionalized with azobenzene have been shown to convert light energy to mechanical work when exposed to specific wavelengths of light. Stimuli-responsive materials may provide significant advantages in applications that require wireless actuation or autonomous adaptation to environmental stimulus. Liquid crystalline polymers are promising materials that have been shown to experience large mechanical deformations under thermal or photo stimulus. However, the fabrication of these materials has primarily been successful in making only 2D polymeric sheets. Therefore, the resulting engineering design space is limited. Our long-term goal is to explore ways in which these materials can be processed effectively using a 3D printer to create more complex 2D and 3D geometries. The first step to achieve this goal is to create a model polymer system based on liquid crystalline monomers. A key feature that these polymers must exhibit is thermoplastic behavior, so that the polymer melts at elevated temperatures which allows them to be printed. To achieve this feature, we studied two polymers systems that feature physical crosslinking. One of the systems that was studied involves the use of metallophilic interactions, which forms a silver ion backbone cross-link in the polymer network. The other system that was explored was a polyimidothioether. These polymers incorporate soft flexible segments that are linked through hard rigid segments that form physical aggregates. Herein, we will summarize the synthesis and some preliminary characterization of these materials. By establishing a robust printable liquid crystalline polymer, the potential exists to design systems that respond to environmental stimuli such as light or heat, making this material attractive for the aerospace, biomedical, and textile industries.

Development of Inexpensive Air Quality Monitors as a STEM Teaching Tool

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For the last several years, governing bodies have encouraged introduction of STEM experiments in teaching curriculum. The air quality monitors offer a way to expose students to data collection and analysis with results that are important to the students. The air quality monitors continuously track particulate matter, CO₂, temperature, and humidity in a location the students want to investigate. The students create their own hypotheses and testing protocols, then conduct the tests and analyze the results. The program has been a powerful introduction to students on collection of real time data and how air quality data is measured.

Does Biochar Improve Disturbed, Sandy Soils?

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*This research was supported
by the Holleman Geology/
Environmental Science
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We studied whether adding biochar to sandy, carbon-poor soil impacts plant growth. Biochar is an organic compound composed mainly of black carbon. Biochar is of interest as a possible soil amendment to alleviate stresses on agricultural production due to its high water and nutrient retention capabilities, high cation exchange capacity, high porosity that increases mycorrhizal growth, and ability to sequester carbon dioxide. Our experiment involved using three different plant types, *Avena sativa* (common oat), *Vigna radiata* (mung bean), and *Raphanus sativus* (cherry belle radish), in greenhouse and garden plot experiments. In the greenhouse we used five different treatments of soil from a demolition site: soil alone and soil mixed with 2%, 5%, 10%, and 20% biochar by mass. Biochar was enriched with nutrients and aerobic bacteria with compost tea. Four replicates of each species were grown for 5 weeks and watered every other day. At the end of the growth period, *A. sativa* and *V. radiata* plants were cut off at the soil surface and entire *R. sativus* plants were removed from soil, then dried in a plant press before weighing. All 60 replicates produced plants, with no statistically significant differences in oat and mung bean above ground biomass or radish whole mass for any treatment. In the garden experiment at a grassed-over former building site, we planted 10 seeds of each plant in each of 5 plots: soil only, 3% compost by mass, 3% biochar by mass, and 3% and 10% biochar inoculated with compost tea. Oats had a 100% germination in all plots while germination in mung bean and radish plots was less consistent. All soil treatments grew plants under controlled greenhouse conditions. The garden experiment, however, suggests that under more natural conditions biochar may foster a better environment for seed germination and survival.



Groundwater under Hope College's Campus: Suspended Load Characterization

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Urban groundwater has received considerable study over the past 30 years due to contamination and subsequent remediation. However, less attention has been paid to the solid suspended load in urban groundwater. This study investigated the fine, near-nano fraction (4.2-0.7 μm) of solids present in groundwater wells penetrating a shallow (3-7m below grade), homogeneous, sandy Midwest aquifer. Two relationships were examined: (1) Whether suspended particle concentration and size distribution are related to current or historical surface land use; and, (2) Whether naturally-occurring suspended fractions can be distinguished from anthropogenic suspended load. Samples were collected from 11 wells and 1 drainage ditch within a 1 km^2 area. Land use areas consisted of street, lawn, sidewalk, parking lot, former industrial location, storm surge basin on former industrial location, municipal drainage ditch, and surface drainage ditch sites.

Suspended particle concentrations and size distributions were determined using spectrophotometric techniques, dynamic imaging particle analysis, and adapted Navier-Stokes settling calculations. Suspended load chemistry was evaluated by SEM-EDS and PXRD analysis and was utilized as a first approximation to distinguish naturally-occurring material from anthropogenically-derived particles.

Preliminary results show the total suspended load concentrations (SLC) range from ~ 140 to 4900 ppm. The highest SLC concentration was observed in the groundwater (GW) beneath a residential lawn. GW under streets, sidewalks and surge basins had intermediate SLC values (1500-2550 ppm), and GW associated with a former industrial site and parking lot had consistently lower SLC (280-1030 ppm). Composition analysis of the $\leq 0.76 \mu\text{m}$ fractions from different locations indicated that silicates of quartz, feldspar and clay are common natural suspended matter throughout the aquifer. The most conspicuous anthropogenic material is graphite/graphitized carbon black, distinguishing the street, sidewalk and surge-basin sites from other land uses. Results suggest that current land-use practices may have greater influence on GW SLC, while historical activities more heavily influence particulate chemistry.

Footprints in the Sand: Determining the Pattern of Human Traffic in a Coastal Dune Complex

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*This work has been supported
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Human trampling is a mechanism for opening and maintaining regions of bare sand on sand dunes. Our goal is to examine patterns of trampling in Lake Michigan coastal dune complexes near Saugatuck, Michigan. Raindrop patterns on sand are recognizable in low altitude aerial photographs, whether acquired using drones or pole aerial photography, and are erased by footprints made since the last rain event. Measuring areas of disturbed and undisturbed sand therefore provides a way to monitor human use of the landscape. The technique is limited by saturation, where new footprints erase old footprints, so a first step is to develop saturation curves. We used two experiments to evaluate saturation over an area and along a trail. In the area experiments, people made 15 passes of 15 steps over a 9 m² area of evenly raked sand for a total of 225 steps. The trail test entails a person making 3 passes at a normal stride back and forth over an area that is 0.62 m by 2.6 m. For both tests, we used a camera on a 4.8 m painter's pole to take pictures between each pass and compared the number of footprints on the photographs to the number of actual footsteps, to create saturation curves. Initial data for the square area test show that the curves are linear to approximately 10 steps per meter square, then level off to saturation at approximately 14 steps/m². Initial data for the trail test show that saturation varies but was reached more rapidly, at approximately 8 steps/m².

Preliminary observations indicate that more trampling in dunes occurs on trails, with less trampling in areas of mixed vegetation and open sand patches adjacent to trails. Furthermore, larger open areas in sand dunes accessed by trails experience high amounts of trampling, in some areas reaching saturation, while comparable open areas not accessed by trails experience low trampling.

Examining the Relationship between Lake Michigan Water Levels and the Ecohydrology of an Interdunal Wetland/Slack on the Southeast Coast of Lake Michigan

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This research is supported by funding from the Hope College Department of Geological and Environmental Sciences and the Natural and Applied Sciences Division.

Interdunal wetlands or slacks are an imperiled ecosystem along the Great Lakes. We initiated an ecohydrological study of an interdunal slack/wetland in the deflation basin of a large parabolic dune ~200m inland from Lake Michigan near Saugatuck, Michigan. The slack formed where wind unevenly scoured the sand to the water table, creating a series of pools and ridges. We reviewed historic aerial photographs together with the Lake Michigan water level curve to examine the relationship between slack features and the lake's hydrology. The earliest photo, 1938, shows three pools along the northernmost edge and emergent wetland vegetation in the northeast corner and along the western edge of the slack. In subsequent photos, larger pond and emergent wetland vegetation areas occurred in years with higher water levels, while smaller pond and emergent vegetation areas occurred in years with lower water levels. Low lake levels from 1998 – 2014 significantly shrank the wetland areas with upland dune vegetation replacing wetland vegetation in many places. Even the northernmost pools were dry during a portion of this time. Rising lake levels (2014 – present) reflooded the wetland. Vegetation quadrat sampling in the summer of 2016 showed dominant wetland species in the slack. Thus, water levels in the slack generally reflect Lake Michigan levels with the ecological communities responding accordingly. In addition, different wetland plant communities and zonation of these communities were noted in the various pools and lobes of this slack, apparently due to different water depths in the respective pools and lobes. This phenomenon is under additional study. Groundwater levels obtained from a slack/dune monitoring well network show that local rain events significantly raise the slack's water levels while not impacting those of Lake Michigan. Hence, water levels within the slack are reflective of both Lake Michigan's levels and local precipitation events.



Bacterial Counts in the Muskegon Area Watershed

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The goal of this experiment was to identify non-sulfur bacteria counts in the Muskegon Watershed area. We did so by cultivating bacteria in twelve different Winogradsky columns to determine if non-sulfur bacteria life is viable in the four different waterways that were sampled: Gilligan Lake, Lake Macatawa, Lake Michigan, and the Kalamazoo River. Bacteria grown in shade had highest colony counts in Lake Macatawa and the forest area of Lake Michigan. Bacteria grown in sunlight had highest colony counts in the forest area of Lake Michigan. Extended research could identify the non-sulfur bacteria types and allow us to discern how each affects the biome in which it lives. This research lays the groundwork for future studies involving sulfur-bacterial growth.

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Day1 Research Program

Incorporating Exogenous Variables in Disease Incidence

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Dengue Fever, Dengue Hemorrhagic Fever, Chikungunya and Zika are four viral diseases which share a common vector, the Aedes mosquito, which is found in tropical and sub-tropical regions of the world. Environmental factors play a role in the survival of the Aedes mosquito. Thus, modeling disease incidence trends using environmental data, as well as information about the diseases themselves, would be a viable approach. Various models (both frequentist and Bayesian) for predicting disease incidence using exogenous variables are suggested and compared; with one of the comparison metrics being prediction accuracy.

The Effect of Step Size on Prediction Accuracy in Time Series Models

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Prediction accuracy of the response variable at future time points in a time series is a function of many factors, one of which is the number of available observations. We look at how adversely larger stepsizes (which are related to the number of available observations) affect prediction accuracy. We also consider the effect of using information from additional predictor variables on prediction accuracy as a function of stepsize.

Growth of Pitcher's Thistle on the Flower Creek Dunes

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Cirsium pitcheri, or Pitcher's thistle, is a plant species found on the sand dunes surrounding the Great Lakes. Its current conservation status is classified as "threatened," or vulnerable to endangerment. Due to being classified as such, plant numbers are monitored to determine whether their population is increasing, decreasing, or stable as well as to chart their growth. As part of a long-term project to study their numbers, data was collected August, 2016 at Flower Creek Dunes in Muskegon, Michigan. Two methods were used in collecting data on Pitcher's thistle populations at this site. The southern side of Flower Creek Dunes was surveyed and a census of the thistles was taken. The northern dune was divided into six large quadrats created using strings, and from each section, six plants were randomly selected and data on them was recorded. For both methods, data was collected on the plants' height, longest leaf length, length of major and minor axes, whether the plant was living or deceased, and number of flowers. The new 2016 data was combined with data gathered in 2014 and 2015. Statistical analyses of the data showed that the proportion of smaller thistles on the northern dune is not significantly different from that of the southern dune. It was also determined that the average longest leaf length increased between 2015 and 2016. Further studies will illumine the long-term growth and survival of Pitcher's thistle at Flower Creek Dunes and may instigate studies at other locations along the Great Lakes.

Predicting Dengue Fever Incidence

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The *Aedes* genus of mosquito is the vector for at least three viral diseases—Dengue Fever (DF), Zika and Chikungunya. In many regions of the world, an upward trend in DF and Zika infections is observed. Using disease data from the Singaporean Ministry of Health and population data from the Singapore Department of Statistics, various statistical models are fit to DF, Dengue Hemorrhagic Fever (DHF; an often-fatal complication of Dengue Fever) and Chikungunya. These models differ in their consideration of the overall data structure, and have different underlying assumptions. Of particular interest is a prediction model based on neural networks, which we present. The merits and performance of these models are discussed and the accuracy of predictions made by each model are compared. The statistical method for determining prediction bounds for the neural network model is also discussed. These prediction models provide an objective method for public health management and policy making.



One Bird, Two Bird?
Red Bird, Blue Bird?
Analyzing Bird
Songs Using Wavelet
Transforms, Image
Processing, and
Neural Networks

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Biologists, ecologists, and bird enthusiasts want to estimate bird population trends in order to monitor changes in ecosystems. Recently, time-consuming field observations of birds have been augmented by audio recordings of birds. In the lab, we deciphered the types of birds singing in these recordings. We used wavelet transforms to convert audio signals into images called scalograms. These scalograms display bird songs in a format similar to sheet music; they show how the pitch and volume of a bird’s song change over time. After applying denoising methods to the images, we trained a neural network to identify the birds from the processed images.

Presence of Community Resources and Its Effect on Health Literacy

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Health literacy (HL) is one of many factors that impacts self-efficacy within healthcare. However, there is limited research on the presence of community resources and their impact on HL. The purpose of this research project was to identify relationships between the number of community resources and the HL rates of a given zip code. Bandura's Self-Efficacy theory supports the idea that cognitive factors, such as HL, affect one's self-efficacy. The sample size of this study was 125, with a majority (72%, n = 90) from eight Grand Rapids zip codes. There were 41.6% (n = 52) males and 58.4% (n = 73) females, with the majority (40.8%, n = 51) being 71 years or older. The majority (31.2% n = 39) reached a high school or GED level of education. The six most reoccurring cities, associated with 14 zip codes, were investigated for the presence of specific community resources: libraries, fitness centers, colleges/universities, and private health clinics. Data were analyzed with SPSS version 23 using descriptive and Kruskal-Wallis test statistics. The 14 zip codes varied in their HL rates. The findings of the Kruskal-Wallis test showed no significant relationships between community resources and HL rates ($\chi^2 = 4.093$, $df = 7$, $p = 0.769$). Therefore, community resources were not found to have a relationship with HL rates. Limitations include a small sample size, cities located relatively close, and lack of knowledge regarding usage of community resources. Implications include proper nursing assessment of HL and community interventions to improve HL resources.

Nursing Leaders in Academia

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Nursing leaders have a formative role in nursing programs; collaborating with community partners and stakeholders, and supporting faculty and other nursing leaders. The purpose of this study was to identify positive and negative themes and examine related factors impacting experiences of nursing leaders. Identity Theory, borrowed from psychology, provided this study's framework because it explains role-related behaviors and their influences. Qualitative descriptive methods were utilized by manually coding five audiorecorded interviews with nursing leaders in Midwestern United States. Significant statements were coded as positive or negative and grouped into themes. Each interviewee's statements were balanced to calculate "net balance." Length of time in position and program size were considered. Limitations included all programs from the Midwest, no male leaders, and leaders with exceptionally high or low satisfaction levels may have been more eager to participate. Results showed that four of five leaders' experiences were net positive. The leader with the least experience reported the highest number of negative statements within the sub-themes of "no preparation," "coercion into role," and "hours." These, with "faculty" and "stressors," constituted the five most negative sub-themes. The five most positive subthemes included "fulfillment," "student contact," "potential for change," "living out the mission," and "influence on others." Experiences were shaped by length of time in role, supporting the notion that transitions into leadership positions lack support. Creating support to allow for greater recruitment and retention of future nursing leaders and ease transition into these positions is recommended.

Nursing Teamwork and Negative Patient Outcomes: A Correlational Study

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Significant implications for patient health arise from the multifaceted dynamic of a nursing team. Nursing teamwork has a substantial contribution to the overall quality of patient care and outcomes. This study's purpose was to investigate the relationship between nursing teamwork and the incidence of various patient outcomes that negatively affect health. It was hypothesized that units with better nursing teamwork as measured by the Nursing Teamwork Survey would yield fewer negative patient outcomes based on quality indicators including restraint use, patient falls, patient falls with injury, catheter-associated urinary tract infections (CAUTI), and central line-associated blood stream infections (CLABSI). The study was framed around Florence Nightingale's Environmental Theory, which emphasizes the value of nurses cultivating an environment that promotes optimum patient outcomes. The retrospective and correlational study included a convenience sample of licensed and non-licensed nursing staff from 37 units within a large Midwestern hospital system. The data were analyzed using SPSS version 23. There was no significant relationship between nursing teamwork and quality indicators including restraint use ($r=-.10$, $p=0.56$), patient falls ($r=-.15$, $p=0.40$), patient falls with injury ($r=.056$, $p=0.75$), CAUTI ($r=-.02$, $p=0.89$), or CLABSI ($r=-.20$, $p=0.24$). In conclusion, these results did not support a relationship between nursing teamwork and negative patient health outcomes. Limitations of the study include convenience sampling, a small sample size, and minimal control over extraneous variables. By examining factors contributing to negative patient outcomes, interventions can be developed to move forward toward reduced healthcare costs and enhanced healing.

Holland Hospital Home Health Telemonitor Initiatives

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This research was supported by Holland Hospital Home Health Care.

Electronic telemonitoring systems have been used in homecare settings to allow close nursing supervision of patient data and rapid response to changes in patient status while allowing patients to maintain control of their care. The purpose of the present study was to examine the relationship between insurance status and hospital readmission rates for participants within a telehealth initiative research study. Dortha Orem's Self-Care Theory suggests self-reliance and responsibility for personal care improves illness prevention and health outcomes. Using Orem's theory as a guideline, ninety-five participants were included in this retrospective chart review. Participants were selected through a convenience sample from a community hospital home health agency in the Midwest over a three-month period. Of the 95 patients, 21.1% ($n=20$) were monitored using telehealth. Data were analyzed using SPSS version 23. The top three admitting diagnoses for readmitted telehealth patients included: cardiac (73.7%, $n=14$), pulmonary (42.1%, $n=8$), and renal (26.3%, $n=5$). There was not a significant relationship between insurance status and telehealth monitoring ($\chi^2 = 2.144a$, $p=0.709$). Some limitations to this study include a small sample size, inclusion of patients readmitted more than once throughout the three-month study period, a lack of accurate census of total telehealth patients, and single site data collection. This research implicates the need for further research in the effectiveness of telehealth and the prevention of hospital readmission. Using telehealth routinely in the home care setting may allow for increased patient autonomy, safety, and overall promotion of health.

Impact of In Situ Simulation on Role Responsibility as an Educational Response in the Emergency Department

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Interdisciplinary teamwork and individual role awareness of health care workers impact patient care in acute situations. The purpose of this quality improvement study is to measure the impact of in situ simulation on scope of practice as an educational delivery method within interdisciplinary teams in Butterworth Hospital's Emergency Department (ED). The nursing framework that shaped this study is Hildegard Peplau's Theory of Interpersonal Relations, because it focuses on the nurse's roles in interpersonal relationships with the patient and others. The study design will be observational, focusing on quality improvement in the Spectrum Health Butterworth Hospital ED. Using the Clinical Teamwork Scale (CTS), assessors will observe and evaluate interdisciplinary teams during an in situ simulation intervention focused on emergency care. The sample size is yet to be determined and will consist of a multidisciplinary convenience sample in the Spectrum Health Butterworth Hospital Emergency Department. The multidisciplinary team will consist of providers, nurses, nurse technicians, respiratory therapists, pharmacy and others. Data will be analyzed using SPSS version 23. The results and conclusions of the study are yet to be determined. Limitations include that the CTS limits measurements because it assesses the team as a whole instead of individual team members. The study will also use a small sample size at a single site. Implications of the study will focus on quality improvement in the hospital and will be distributed and discussed as Spectrum Health sees fit. The findings will be used for education benefit throughout Spectrum Health and specifically the ED.

Apathy, Sleep Disturbance, and the CLOCK Gene among Persons with Alzheimer's Disease

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Sleep disturbance and apathy are common symptoms among persons with Alzheimer's disease (AD). The Circadian Locomotor Output Cycles Kaput (CLOCK) gene assists in regulating circadian rhythms and prosocial behaviors. Additional research is needed to better understand how the CLOCK gene modifies these patterns in persons with AD. This study was based on the Need-Driven Dementia-Compromised Behavior Model that focuses on understanding difficult behaviors, including sleep disturbance and apathy. The first aim of this comparative study was to amplify a specific region of the CLOCK gene containing the single nucleotide polymorphism (SNP) of interest, rs6832769, using real time polymerase chain reaction. The second aim was to analyze relationships between genotype data and phenotype data, including sleep disturbance and apathy subscales of the Neuropsychiatric Inventory (NPI). Allelic discrimination was used to determine genotype frequency among 115 persons with AD from institutional facilities and community settings. Frequency of genotypes was as follows: AA genotype: n=53 (46%); AG genotype: n=37 (32%); GG genotype: n=13 (11%). There were 12 undetermined samples. One-way ANOVA was conducted using SPSS Version 23 to compare mean apathy severity score by genotype. A trend emerged between apathy severity and CLOCK gene SNP rs6832769, where persons with the GG genotype were less likely, though not significantly, to display more severe apathy ($F=0.07$, $df=2$, $p=0.93$). The study was limited by testing only one SNP and by sample size, as there was only NPI data for a subset of 48 of the 115 participants with very few experiencing sleep disturbance ($n=8$). With further investigation, targeted nonpharmacological nursing interventions may be used within this population to promote more regular sleep schedules and to reduce apathy.

Relationship between Age and Outcomes of Patients Receiving Manual versus Mechanical Chest Compressions

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This research was supported by Spectrum Health.

Cardiopulmonary resuscitation (CPR) is typically performed as treatment for patients presenting with cardiac arrest. Recent advances in medical technology have introduced the use of mechanical chest compression devices, such as the LUCAS 2, which may lead to improved quality of compressions in circumstances requiring prolonged CPR. The purpose of this quality improvement project was to examine the relationship between age and the outcomes of patients receiving manual versus mechanical chest compressions in the emergency department. Jean Watson's Theory of Caring addresses problem solving and decision making as important components of caring for patients and was used to shape this study. A retrospective chart review of 62 patients who presented with cardiac arrest in the emergency department of a Magnet designated hospital in the Midwest compared patients receiving mechanical CPR (45.2%, n=28) to patients receiving manual CPR (54.8%, n=34). Binary logistic regression analyses were performed to predict outcomes (return of spontaneous circulation) based on age for patients who received mechanical or manual CPR using SPSS version 23. 25.0% (n=7) of patients receiving mechanical chest compressions achieved return of spontaneous circulation compared to 58.8% (n=20) of patients receiving manual chest compressions. Age contributed significantly to prediction of the outcome of patients who received mechanical chest compressions (p=.038), but not for patients who received manual chest compressions (p=.092). Because age is a significant predictor of the outcome of patients who receive mechanical chest compressions, it should be considered when deciding on device implementation. Limitations include a convenience sample from a single site and some incomplete data. In addition to the American Heart Association guidelines, with increased knowledge about the LUCAS 2 device and patient outcomes, nurses can advocate for appropriate use of the device to ensure that patients are receiving high quality care.

In Situ Simulation and Confidence in Performing the Nursing Process during a Septic Medical Emergency

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This research was supported by Spectrum Health.

The use of in situ simulation has been effective in improving technical and non-technical skills as well as increasing patient safety in highly stressful environments. The purpose of this project is to determine whether in situ simulation has an educational impact on nurses' confidence in performing the nursing process during a septic medical emergency as measured by the Simulation Based Learning Evaluation Scale (SBLES). This project is based on Lewin's Change Theory, which states that change follows the process of unfreezing and refreezing. This creates a standard to be used as nurses participate in the in situ simulation and potentially change their confidence levels in assessing, diagnosing, planning, implementing, and evaluating patients. Implementation will be performed at a Level 1 Trauma Center Emergency Department (ED) in West Michigan in a hospital that is Magnet recognized. It is a quality improvement project with a pre and post survey to evaluate a pilot educational intervention with ED nurses. Sample size is yet to be determined, but will be obtained through convenience sampling. Data analysis will be conducted using SPSS. Results and conclusions are yet to be determined. Limitations include being a pilot study and a single site setting. Implementation of this study will provide ED nurses with additional practice to enhance their learning and confidence in performing the nursing process in the emergency setting. It will also suggest whether the use of in situ simulation as an educational intervention is a feasible tool for nurses to use in the ED at Spectrum Health.

Emergency Department Nursing Education Interventions for Compassion Fatigue

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Nurses who work in the emergency department (ED) are exposed to many complex situations. While nurses may develop compassion satisfaction from providing care that matters, they are also at risk for developing compassion fatigue that can lead to burnout and secondary trauma. The purpose of this study was to develop an educational intervention to decrease compassion fatigue in emergency department health care professionals (HCP). Based on the results of a literature review, an educational brochure was developed. This educational intervention is a component of a larger research study in a 300-bed, Midwestern hospital. The conceptual framework for the larger study is the Compassion Fatigue and Compassion Satisfaction Theory Model (Stamm, 2009). HCP, consisting of medical doctors and registered nurses, using a non-randomized sampling technique, were asked to complete the PROQOL-5 scale to determine the baseline degree of compassion fatigue in the ED. An educational brochure developed by the researcher will be distributed to the HCP. The HCP will be asked to repeat the PROQOL-5 at 2-months and 6-months after the brochure has been distributed. Descriptive statistics and a one-way ANOVA, using SPSS v.22, will be conducted to analyze data. Results will be limited by the non-random sample and by empathy training provided for each employee during the larger research study. Results and conclusions are pending. Compassion fatigue can lead to secondary trauma, and eventual burnout if not properly addressed in the hospital setting, which can ultimately affect the quality of care patients receive.

Genotyping within the Oxytocin Receptor (OXTR) Gene and Apathy among Persons with Alzheimer's Disease

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Apathy, defined as a disorder of motivation, is a prevalent neuropsychiatric symptom among persons with Alzheimer's disease (AD). Variations within the Oxytocin Receptor (OXTR) Gene are hypothesized to be candidate modifiers of apathy symptoms in persons with AD. These variations are called single nucleotide polymorphisms (SNPs). The aim of this study was to amplify SNPs of interest in order to generate genotype data for 115 DNA samples collected from patients with AD. The allelic discrimination feature of real time polymerase chain reaction (RT-PCR) and primer-probe sets were used to amplify OXTR SNPs rs2268498, rs237885, rs237887, and rs237902. Genotype frequencies for each of the SNPs of interest were as follows: rs2268498 [22.6% (n=26) CC, 46.1% (n=53) CT, 23.5% (n=27) TT, 7.8% (n=9) Missing], rs237885 [21.7% (n=25) GG, 46.1% (n=53) GT, 27.0% (n=31) TT, 5.2% (n=6) Missing], rs237887 [28.7% (n=22) AA, 47.0% (n=54) AG, 18.3% (n=21) GG, 6.1% (n=7) Missing], and rs237902 [13.0% (n=15) AA, 42.6% (n=49) AG, 36.5% (n=42) GG, 7.8% (n=9) Missing]. Genotype data will be analyzed and compared to previously collected phenotype data, including apathy symptoms as measured by the Neuropsychiatric Inventory. Findings may contribute to identifying individuals with AD more at risk for apathy based on OXTR genotype.

**No Pass Zone:
Call Light Response
and Interdisciplinary
Teamwork**

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The No Pass Zone is a nursing intervention that focuses on patient call light use and nurse responsiveness to call lights, which affects patients’ safety and satisfaction. When a call light is activated, all staff should appropriately respond. The aims of the study examined what professions passed call lights and if more call lights were passed in the morning versus night shift. Ida Jean Orlando’s process discipline theory explains that the role of the nurse is to find out and meet the patient’s immediate needs for help. The No Pass Zone tool was used to record observations. A convenience sample of 59 call lights was observed at a community hospital in West Michigan. Descriptive statistics and a chi-square test were analyzed using IBM SPSS Version 22. Results showed that of the 20 call lights that were passed, 8 call lights were passed by more than one type of personnel. Nursing techs had the highest number of passed call lights. The chi square analysis showed that significantly more call lights were passed during the night shift versus the morning shift ($p=0.02$). Limitations include the potential for data collectors to influence staff behavior, small sample of call lights observed, and convenience sample of call lights. These results demonstrate that multiple personnel are passing activated call lights suggesting that the No Pass Zone might may serve as an interprofessional intervention to decrease response times and increase patient safety. Also, The No Pass Zone intervention could be emphasized on the night shift because of the increase in passed call lights, which can indicate a higher risk for falls. Implications include educating non-medical personnel how to respond to call lights, promoting good communication among the interdisciplinary team, and increasing patient satisfaction and safety.

**Using the LUCAS 2
Device According to
American Heart
Association Guidelines:
Quality Improvement**

Mallory Murphy

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The Lund University Cardiac Assist System (LUCAS 2), was created in 2011 to deliver standardized mechanical chest-compressions to patients experiencing cardiac arrest. The device use is increasing in the hospital setting. The American Heart Association Guidelines recommend “against the routine use of automated mechanical chest compression devices to replace manual chest compressions.” The same guidelines suggest that the device should only be used in situations where prolonged chest compressions are anticipated or provider safety is compromised. The purpose of this quality improvement project is to examine whether the device is being used in the hospital setting according to the American Heart Association’s Guidelines. Myra Levine’s nursing conceptual framework of the four conservation principles, particularly conservation of energy, was used for understanding the use of the LUCAS 2 device. This was a retrospective chart review conducted in the Emergency Department of a Magnet designated hospital in West Michigan, using a convenience sample of 62 cardiac arrest cases that occurred since the device was first launched in January through July of 2016. SPSS version 23 was used to determine frequency of device use as well as indications for those uses such as cath lab or other advanced interventions like ECMo or Cooling protocols that might compromise provider safety. The device was used in 45.16% ($n=28$) of cardiac arrest patients. The device was used with no apparent indication on 14.5% ($n=9$) of patients. Therefore, there is room for improvement for using this device with the American Heart Association’s guidelines. Limitations include a small, non-representative sample. Further research should be done to generate results that can be generalized to the larger population. Previous research has shown that the LUCAS 2 device can improve patient outcomes, therefore nurses should advocate for the use of the device in accordance with the American Heart Association’s guidelines in order to provide patients with the best care possible.

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by Spectrum Health.*

Examining Various Age Groups and Ethnicities as Potential At-Risk Populations for Low Health Literacy

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*This research was supported
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Levels of health literacy have been shown to be indicators of patients' future health outcomes. Low health literacy levels have been linked to poor self-care following hospitalization, difficulties in following medical instructions, and increased hospitalizations. The purpose of this study was to identify potential at-risk populations in order to improve patient education and health literacy. The Health Literacy Framework was used as a foundation to this study to show the link between literacy and patients' abilities in health contexts. This study was a prospective, descriptive study which used a demographic survey asking questions such as ethnicity and year of birth and the Short-Form Test of Functional Health Literacy in Adults (S-TOFHLA). Using random stratified sampling, 290 participants were selected from a teaching hospital in the Midwest. Of those participants, 237 were white and 32 were non-white. There were 99 participants who were born before 1945, 109 between 1946-1964, 43 between 1965-1983, and 18 after 1984. The data were analyzed using SPSS software version 23. A Mann-Whitney test found that there was not a significant relationship between health literacy and ethnicity ($U = 3678, p = 0.743$). A Kruskal-Wallis H test found that there was a significant relationship between health literacy and age ($\chi^2 = 33.271, p = .000$). These results show that health literacy can be related to age, but not to ethnicity. Limitations for this study include exclusion of non-English speakers, a homogenous population, conducted at a single site, and possible skewed data due to patients with low health literacy declining to participate. Implications of the findings include identification of at-risk populations with low health literacy, in an effort to improve patient education and health outcomes.

The Use of Debriefing Sessions in Emergency Room Nurses Experiencing Moral Distress

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Moral distress has been widely studied in certain areas of the healthcare field, such as critical care or oncology units. Less is known about this phenomenon in emergency departments. The purpose of this study was to determine whether debriefing sessions help reduce the amount of moral distress in emergency room nurses. Epstein and Hamric's framework for the crescendo effect will be used as a foundation for this study. A convenience sample of emergency department nurses at an inner city, Midwestern hospital will be asked to complete a self-administered, online survey before and after a group debriefing session within two days of a stressful patient encounter. The Moral Distress Survey Revised (MDS-R) by Ann Hamric will be used to determine if the nurses' degree of moral distress decreased after the debriefing session. Data will be analyzed using SPSSv22 and paired t-tests will be conducted to compare pre and post scores. Implications of the study include providing a debriefing session after stressful patient encounters for all care providers in the ED. Limitations of this study include the small sample size and a single site survey. Further research needs to be conducted on other interventions in the future. Results and conclusions are pending.

Learning Needs Assessment: Comparing Direct Care Registered Nurses' Learning Needs over Time

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The Magnet Recognition program criteria includes an assessment of the continuing education (CE) needs of nurses at all levels and settings as a component of recognition for nursing excellence. In 2012 and 2015, a survey was sent out to all nursing staff at a large tertiary care hospital in West Michigan to assess the top learning needs of direct-care registered nurses (RNs). The purpose of this study was to identify how the top learning needs of direct-care RNs have changed from 2012 to 2015 in the areas of interdisciplinary teamwork, interprofessional issues, and client care. Benner's Novice to Expert framework, which explains how nurses' skills and knowledge levels increase over time with clinical experience, was used to guide this study. The survey was sent out via email at both time points and responses were electronically recorded. A total of 767 direct-care RNs responded to the 2012 survey, while 654 responded in 2015. Learning needs were scored on a Likert scale ranging from 1 (strongly agree) to 5 (strongly disagree). Data analysis was performed using SPSS. T-tests showed no significant changes in scores for interdisciplinary teamwork ($t=0.88$; $p=0.38$), interprofessional issues ($t=0.90$; $p=0.37$), or client care ($t=1.08$; $p=0.28$). There was a trend in increased learning needs for interdisciplinary teamwork and interprofessional issues, while client care was stable over time. Limitations include lack of generalizability outside of West Michigan. Implications include implementing CE programs to address nurses' skills and knowledge in client care, as this had the highest need for additional learning.



Health Indicators and Health Literacy of an Older Adult Population with the Institution of a Nurse Managed Wellness Center

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This was partially funded by the Community Foundation of Holland/Zeeland.

Federal standards define a vulnerable population for older adults as individuals the age of ≥ 65 with chronic disease and limited resources for health. Thirteen percent of individuals 65 and older account for 34% of national healthcare expenditure. Therefore it is important to develop strategies to promote and maintain this population's health. The purpose of this study describes trends in health indicators and health literacy in an older adult population meeting the federal definition of being vulnerable. The sample received services from an onsite student nurse managed wellness program and clinic (SNMWP). This convenient sample, ≥ 55 years, resides in a lower income, independent living community in Western Michigan, living with at least one chronic disease or disability. King's Theory of Goal Attainment was used as it supports relationship building to achieve attainable health goals. A retrospective chart review obtained data on health indicators from the first year of the SNMWP. The BRIEF health literacy screening tool was used to survey the participants for their level of health literacy. Previous literature indicates this as a reliable and valid tool. SPSS 21 and descriptive statistics were used for data analysis. Of the 117 residents on site, twenty-five (21.40%) attended the clinics regularly (females: $n=16$; males: $n=9$). Attendance at residential activities ranged from 3-35 participants weekly. Mean findings from several health indicators reveal the following: random blood sugars $m = 125.84$ ($SD = 32.36$); blood pressure $m = 132.39/74.86$, ($SD=9.874/8.17$); pulse oximetry $m = 96.83$ ($SD=1.03$). The BRIEF health literacy findings ($n = 8$) indicate that 62.5% had adequate health literacy scores; 25% marginal scores; and 12.5% limited scores. In conclusion, participants' health indicators were within normal ranges. Participants were also fairly health literate at the end of the first year of the SNMWP, but may need occasional outside assistance. Limitations include a small sample size, a convenient sample, limited sample diversity, and single site data collection. Implications for nursing indicate on-site nursing clinics may help to improve participants' health indicators and health literacy. Attainment of health care goals can be improved by creating a trusting environment for residents. However, more research is necessary over time to compare differences and relationships in the data.

Developing and
Implementing In-Situ
Simulation Education
for Emergency
Department Nurses

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In situ simulation can be a vital way to educate nurses and promote learning and improvement related to various areas and responsibilities of nursing. The purpose of this quality education simulation project is to evaluate whether in situ simulation in the emergency department promotes improvement in self-perceived attitude of reflection and objective patient friendliness. Lydia Hall's Care, Cure, Core Theory of Nursing serves as the theoretical framework for this study, as it views the patient holistically, interacting with nurses and other medical professionals, as is seen in the emergency department. A literature review was done to determine ways to evaluate nursing teamwork and simulation-based learning and develop an in situ simulation based on emergency nursing needs. This simulation will be performed in the emergency department of a large, Midwest teaching hospital as a septic emergency case. Members of an emergency-response team, including 2-3 nurses and other interdisciplinary members, such as physicians and nurse technicians employed by the hospital, will complete a pre-and post-Simulation-Based Learning Evaluation Scale (SBLES) and the in situ simulation. Nursing students or the hospital nurse educator will complete the Clinical Teamwork Scale. Survey data will be analyzed using SPSS version 23. Results and conclusions are pending. Literature suggests that in situ simulation education will result in improved nursing teamwork and attitude of reflection, and therefore should be utilized for quality improvement in emergency nursing care. A small sample of medical professionals will be used in a single emergency department, so generalization to all hospitals is not conceivable. If found that in situ simulations can be an effective delivery method for education of emergency department nurses, it will be important to implement them frequently to improve the quality of nursing teamwork.

Refining the R-process with the SuN Detector at the National Superconducting Cyclotron Laboratory

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This material is based upon work supported by the National Science Foundation under Grant No. PHY-1306074.

Where did all of the heavy elements originate? The rapid neutron capture process (r-process), currently only characterized by theoretical calculations, model the nuclear reactions that lead to heavier nuclei in intense astrophysical locations such as supernovas. Experimenting with the few reactions reproducible on Earth can refine the theoretical calculations of reactions currently impossible to replicate. A cocktail beam of heavy nuclei associated with the r-process around ^{104}Nb with a magnetic rigidity of 3.2097 Tm was produced at the National Superconducting Cyclotron Laboratory. The beam implanted in an energy and position detector located inside an efficient gamma detector called the Summing NaI(Tl) detector (SuN). Beta-decay events were correlated to implantation events to identify the A and Z of the decayed nucleus. Using the correlated gamma-ray energies measured in SuN, values such as the beta-decay intensity distribution will then be calculated and compared to values predicted by models that are used to calculate the abundance distribution of the various nuclei observed today.

Characterization of Cation Intercalation in Surface Bound Prussian Blue Analogues

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This material is based upon work supported by the Hope College Department of Physics, the Hope College Dean for Natural and Applied Sciences Office, and the National Science Foundation under NSF-MRI Grant No. CHE-0959282.

With the increasing popularity of handheld, rechargeable devices (such as smartphones) the demand for Lithium-ion batteries has also increased to fill this need. Alternative battery types provide an opportunity to lower costs by using more earth abundant elements. Prussian Blue Analogue (PBA) films are one alternative that have the benefit of admitting a more diverse range of ionic intercalants than lithium. This study focuses on the characterization of PBA films which are exposed to a variety of cations (Li^+ , Na^+ , K^+) that differ from the initial solution in which they were created. We found that some films would exhibit enhanced features, such as, a larger charge capacity. Preliminary results demonstrate that some cation intercalants are more kinetically favorable, and out-compete each other for interstitial site occupation within the PBA lattice. Further research could look to the effect of using 2+ ions (Mg^{2+} and Ca^{2+}) as the intercalant.

Exploring Quantitative Analysis of Metalloprotein Stoichiometries with PIXE and NRA

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While approximately a third of all proteins are metalloproteins, their stoichiometric ratios are still largely unknown. Current elemental analysis procedures are capable of determining which metals are in a protein, but it is difficult to determine how many. To address this, an ion beam analysis method is being developed using Particle-Induced X-ray Emission (PIXE) and Nuclear Reaction Analysis (NRA). PIXE determines the elemental composition of the sample and provides a metal-to-metal ratio while NRA uses Rutherford scattering cross-sections to determine an exact ratio of number of atoms to number of proteins. This combination makes it possible to accurately determine the desired metal-to-protein stoichiometric ratio. In order to ensure accuracy, this method is being developed on Cyanocobalamin (B12) and checked against Cytochrome C Equine which have known stoichiometries. This method will allow us to obtain the atomic ratios of additional metalloproteins with confidence. Recent advances include revising sample preparation, refining the substrate, and improving data analysis. Current work includes expanding the data set to include more metalloproteins.

Exploring the Effects of Copper on Composition and Charge Storage of Prussian Blue Analogue Pseudocapacitors

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As energy usage has increased in recent years, there has been great demand for efficient, cost-effective, and earth-abundant materials to be used for energy storage. The ability to produce hexacyanoferrate (HCF) modified nickel film for use as a pseudocapacitor has already been demonstrated. This project focuses on the effects on the modification procedure and the resulting material of adding copper to the nickel metal film. A NiCu film was deposited onto a gold substrate with a controlled potential electrolysis experiment, then was modified and characterized with a cyclic voltammetry experiment. The composition was determined with a scanning electron microscope with energy dispersive x-ray spectroscopy before and after the modification process. Copper was selectively removed in some cases as a result of the modification. With increased levels of copper, the material can become structurally unsound and result in unintentional stripping of the material. Preliminary data suggests that as the pre-modification level of copper is increased, the resulting charge storage of the HCF film increases as well.

Electronic Nonlinearity in Superconducting Resonator Devices

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This material is based in part upon work supported by the National Science Foundation under Grant No. DMR-1505617.

Superconducting resonators play an integral role as circuit elements in the microwave filters that are used in wireless applications, primarily for base stations in cellular networks. Compared to their conventional counterparts, superconducting resonators in these systems greatly reduce signal loss and improve the frequency response shape factor. However, superconducting materials can degrade certain device performance metrics. Nonlinearity evident in intermodulation distortion (IMD) produces spurious signals that conventional microwave filters would not produce. At Hope College, a test system has been constructed to characterize these nonlinearities. Four main points of focus take precedent in this work: the high-power saturation of IMD, the influence of probe power on saturation, the distinction between saturation in second and third order IMD nonlinearities, and the influence of temperature on saturation, especially near the superconductor critical point. In this paper, saturation of second and third order nonlinearities will be presented. Second and third order IMD nonlinearities are found to possess different saturation characteristics, indicating that different mechanisms are responsible for different orders of nonlinearity.

Two-Dimensional Imaging of Intermodulation Distortions in a Superconductor Resonator

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This material is based in part upon work supported by the National Science Foundation under Grant No. DMR-1505617.

At the resonant frequency, superconducting resonators produce intermodulation distortion (IMD), smaller unwanted signals near the resonant frequency. These signals are a measure of the ratio between fundamental frequencies and distortion products. By inducing external microwave signals, it is possible to analyse the patterns of IMD in several different types of superconducting resonators. These measurements can be used to complement the main peak values like quality factor and frequency shift in order to understand nonlinearities present in the material of the superconductor. Once IMD measurements are taken, they were combined into a 2-dimensional raster image of the resonator chip.

Electrochemical vs. X-ray Spectroscopic Measurements of $\text{NiFe}(\text{CN})_6$ Crystals

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This research was made possible by the Hope College Department of Physics Dr. Harry F. and Jeannette Frissel Research Fund, and the National Science Foundation under NSF-RUI Grant No. DMR-1104725, NSF-MRI Grant No. CHE-0959282, and NSF-MRI/RUI Grant No.0319523.

Pseudocapacitive materials like hexacyanoferrate have greater energy storage capabilities than standard capacitors while maintaining an ability to charge and discharge quickly. By modifying the surface of an electrodeposited nickel thin film with a layer of hexacyanoferrate, we can enhance its electrochemical properties. Charging and discharging these modified films using cyclic voltammetry (CV) allows us to obtain a measurement of the electrochemically active iron in the film. To determine how closely this resembles the full amount of iron in the film, we measure the films' composition using particle-induced x-ray emission (PIXE). We also vary the amount of nickel deposited, both to compare the electrolysis value of charge deposited to the PIXE measurement of nickel in the film, and also to measure how varying the thickness of the nickel surface to which hexacyanoferrate adheres affects the presence of iron in the film. Comparisons of the CV and PIXE measurements show agreement in nickel levels but disagreement in iron levels. PIXE measurements of iron in the film have positive correlation with nickel in the film, possibly because there is more nickel available to be incorporated into the hexacyanoferrate crystal lattice. This correlation between PIXE nickel and PIXE iron measurements suggests that PIXE provides a reliable measure of iron in the film. This in turn implies that a variable proportion of total iron in a given film is electrochemically active.

Neutron Radioactivity in ^{26}O

Cole Persch

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Currently there is only one likely case of neutron radioactivity. This unique occurrence is found when observing the neutron-rich ^{26}O . This isotope of oxygen is particularly interesting because it is theorized to live much longer than nearby isotopes. In order to gain a better understanding of neutron radioactivity, the MoNA Collaboration is working to find the lifetime of ^{26}O . Understanding why this isotope lives longer than similar ones will provide insight into how the nuclear force works in neutron-rich nuclei. In order to experimentally determine the lifetime, our team is finding the change in energy during the emission of neutrons. My role is to find the energy of the neutrons after they have been emitted from the nucleus using an array of 288 neutron detectors.

Crystalline Channeling of MeV Ion Beams

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This research was supported in part by an award to Hope College from the Howard Hughes Medical Institute through the Undergraduate Science Education Program and by the Hope College Department of Physics.

Thin films of strontium titanate (SrTiO_3) on single crystal magnesium oxide (MgO) substrate and strontium manganate (SrMnO_3) also on single crystal MgO substrate are being considered for use in engineered superlattices. These superlattice structures exhibit unique properties which make them valuable in the semiconductor industry as well as applications which require a high sheering resistance. Crystal matching of the films to the substrates, which is essential for a low defect density, is indicated by effective channeling of ion beams through the lattice. Ion beam channeling, which occurs when the beam's incident angle is parallel to crystal planes, can occur in well-ordered and pure crystals. With the addition of the ability to control the azimuthal angle as well as the altitudinal angle, two dimensional rastering of the incident angle is achieved. Comparison of the backscattering yields at different incident altitudinal and azimuthal angles shows a drop in yield as the channeling angle is approached. Channeling is seen in both the bulk SrTiO_3 and MgO samples, although the yield suppression revealed structure around normal incidence. This structure is observed to be consistent between two MgO samples obtained from different suppliers and has different spacing in peaks than the SrTiO_3 sample.

Response of Surface Bound Hexacyanoferrate Films to Binary and Ternary Metal Alloys

Rylan Prafke

Mentor:

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Physics

This work was generously funded by the Hope College Dean for Natural and Applied Sciences Office, the Hope College Department of Physics, and the National Science Foundation under NSF-MRI Grant No. CHE-0959282.

Recently, there has been an increase in the use of intermittent renewable energy sources. By possessing a large volumetric charge density while maintaining rapid charging and discharging rates, electrochemical capacitors contribute to the diversity of energy storage materials that are needed to accommodate these new demands. In particular, hexacyanoferrate (HCF) films possess a crystal structure which remains physically unaltered during charge cycling, making it an ideal candidate for a durable pseudocapacitor. Transition metals were deposited onto a gold substrate from solution using an electrochemical cell to produce a NiCo or NiCoCu backbone for the thin films. These films are studied in a scanning electron microscope (SEM) with an energy dispersive x-ray spectroscopy (EDS) attachment to determine their structures and compositions. This particular study focuses on how the composition and processing of the metal layer affects the HCF film properties including charge storage, charge/discharge rates, and qualitative surface characteristics. Preliminary results suggest that the alloy processing contributes only slightly to variations in electrochemical properties.

Determining the Nuclear Structure of Unstable ^{25}O

Caleb Sword

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This material is based on work supported by the Hope College Dean for Natural and Applied Sciences Office and the Hope College Department of Physics Frissel Research Fund.

One of the primary goals of nuclear physics research is to better understand the force that binds nucleons. This can be accomplished by studying the structure of neutron-rich isotopes. For this experiment, excited ^{25}O nuclei were formed by a collision between a 101.3 MeV/u ^{27}Ne ion beam and a liquid deuterium target at the National Superconducting Cyclotron Laboratory (NSCL). One resulting reaction involved two-proton removal from ^{27}Ne particles, which created excited ^{25}O nuclei that decayed into three neutrons and an ^{22}O fragment. The four-vectors for the neutrons and ^{22}O fragments were determined, allowing the calculation of the decay energy for this process on an event-by-event basis. However, another reaction would also take place, in which an alpha particle was stripped from the beam, creating ^{23}O nuclei that decayed into an ^{22}O fragment and a single neutron. In order to distinguish between ^{22}O fragments and neutrons from both ^{25}O and ^{23}O isotopes, members of the MoNA collaboration are conducting GEANT4 simulations of each decay process in order to uncover their distinguishing characteristics. By successfully correlating simulated decay processes to experimental data, the relative cross sections of the two decay processes will be determined, and their decay energies will reveal more about their nuclear structures.

Spectroscopic Emission from Argon and Nitrogen Microplasmas

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This work was supported by the Hope College Dean for Natural and Applied Sciences and the Hope College Department of Physics, and is based on earlier support from the Michigan Space Grant Consortium.

Many electronics use microgaps as tuning elements for high frequency operation. The residual gas inside these microgaps can breakdown into a plasma either unintentionally or by design. The breakdown condition and spectral emission of nitrogen and argon plasmas were examined under microwave excitation. The differences among the plasma discharges were studied in three different microgap ranges using nitrogen and argon. The breakdown condition was defined as the input power that ignites microplasma, and the breakdown condition exhibited three distinct pressures. These three ranges were: under 10 torr, multipactor branch, 10–300 torr, Paschen branch, and 300–700 torr, diffusion-drift branch. A high resolution diffraction grating spectrometer was used to test nitrogen and argon by exploring the emission spectra and by comparing the spectra from microgaps to large gaps across these three pressure domains, revealing suppression and enhancement of spectral peaks in the microgaps compared to large gaps. As examples, enhancement is shown in a gap of 15 microns and is then suppressed in a gap of 1.6mm. A similar peak suppression occurs in Argon at wavelengths of 591.2nm with a 4 -> 6 vibration transition and 419.8nm with a 2 -> 4 vibration transition.

The Language of Gender

Nicolette DeSantis

Mentor:

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Communication

This research addresses how language and gender co-construct. We focus our analysis through three overarching questions: 1) How does language reinforce the gender binary? 2) How does language give power and preference to one gender over another? and 3) What are the long-term effects of reinforcing the binary and/or favoring one gender's voice over another's? To facilitate our discussion of these questions, we review key theories of gendered communication, specifically from authors Judith Butler and Adrienne Davis. From there we went on to use three-real world case studies, focusing on women in politics, "bro talk", and how women conversationally say "no" to sexual advances, as evidence for the ways in which these theories are seen in society. Ultimately, we found that language and gender co-construct in both subtle and glaringly obvious ways that give preferential treatment to one gender over the other. We conclude by developing practical discussion questions and recommendations that will guide undergraduate students as they think through the complexities of language and gender.

Romantic Relationships and Instagram: How Relationship Duration and Gender Affect the Frequency of Social Media Posts

**Taylor Gram
Kara Huber
Erin Murphy**

Mentor:

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Communication

Relationship maintenance, or participating in behaviors to keep romantic partners satisfied, has been discussed as being an important part of romantic relationships for the last few decades. In recent years, relationship maintenance has been more prevalent through the use of social networking sites. We predicted that Instagram posts about one's relationship would be most frequent at the beginning of the relationship, and would decrease the longer the relationship persists. To test our prediction, we surveyed participants ($N = 81$) who were in committed romantic relationships and measured the length of their relationship as well as the frequency with which they post about their relationship on Instagram. Contrary to our prediction, relationship length was positively associated with Instagram posting frequency. Also, women posted slightly more than did men.

Speed-Discussion: Engaging Students in Class Discussions

Kristen Noack

Mentor:

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Communication

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by an Undergraduate
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available through the Hope
College Advancement Office.*

Engaging college students in class discussion is an often difficult, yet crucial part of the classroom learning experience. My research examines the importance of student engagement in class discussion, and the causes behind the current trend that shows a decline in student engagement in the classroom. Multiple factors contribute to this decline. Based on this information, an activity is proposed that can help engage college students. The Speed-Discussion activity meets the need for engagement by getting students thinking and talking in a dynamic, supportive, and social environment. This activity helps students identify and review the central ideas from readings, and creates a record of their ideas that they can draw upon in later discussions. By the end of the activity, students should be able to (1) provide their own examples for difficult communication concepts, (2) work effectively with their peers, (3) understand a given case-study from a variety of perspectives, and (4) be prepared to contribute to a whole class discussion regarding sensitive, complex, and/or theoretical communication topics.

A Feminist Reading of *Darling* Magazine

Kelsie Nyhuis

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Communication

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by an Undergraduate
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available through the Hope
College Advancement Office*

This project aimed to analyze how women are portrayed in *Darling* magazine. Models and photographs in issues from 2015 were the primary objects of analysis, but the context within which these images appeared was also analyzed. The method used was textual analysis.

Darling is 100% advertisement-free, but still features full-page photos of women. The models tend to be dressed more artistically than sensually, and the magazine claims to focus on women of different ethnicities, upbringings, and job descriptions, in an attempt to increase their readership by broadening their appeal.

Although *Darling* magazine states that it is trying to reshape how women are represented in the media by attempting to define modern femininity, the ways in which they define modern female bodies remains unclear. In this project, I used the theoretical concept of hegemonic femininity to examine the objects of analysis. Hegemonic femininity refers to the ways in which traditional norms for women are normalized and remain dominant. This hegemony is often maintained through media representations. Qualitative textual analysis revealed that *Darling* magazine uses specific aesthetics to appeal to middle and upper-class women and although models and photos challenge beauty ideals of hegemonic femininity, the stories in the magazine are fairly stereotypical.

In conclusion, I found that *Darling* is trying to break the mold of typical women's magazines by photographing models of different races, sizes, and ages. However, there are still problems with the periodical, such as cost, the type of issues they focus on, the limited amount of issues per year, and the lack in this type of media that is accessible for women all over the world. Thus, hegemonic femininity is maintained through non-image-based features rather than images.

Interpreting Emojis: Millennials versus Non-Millennials

Laurel Post
Erika Ryan
Amanda Shepherd

Mentor:

Dr. Jayson L. Dibble,
Communication

The presence of emoticons—and now emojis—within written messages has increased since the advent of electronic communication. We conducted a quasi-experiment to learn whether a “smirk” emoji would be interpreted as indicating seductiveness by digital natives (Millennials) and non-digital natives (non-Millennials). We surveyed participants ($N = 283$) and asked them how they interpreted a message that contained the “smirk” emoji. Millennials were more likely than non-Millennials to infer seductiveness from this emoji. Our data suggest age-related differences in how various nonverbal cues are interpreted within electronic communication mediums.

We’ve Been Trumped! Personality Predictors of Voting Behavior

Allie Schultz

Mentor:

Dr. Deirdre Johnston,
Communication

*This research was supported
by the Communications
Department at Hope College.*

Unlike political propaganda, sociological propaganda creates “an atmosphere that influences people imperceptibly without having the appearance of propaganda; it gets to [people] through [their] customs, through [their] most unconscious habits...as a result, [people] adopt new criteria of judgement and choice...” (Ellul, 1965, 66-73). Ellul continues, “It conditions; it introduces a truth, an ethic in various benign forms, which although sporadic, end by creating a fully established personality structure.” In essence, sociological propaganda insidiously activates personal traits to transform personality into ideology. While much attention has been given to demographic analysis of the electorate following the most recent election, this study proposes to explore the nuances of personality. Because traditional ideologies of liberal and conservative voting block interest groups fail to explain the outcome of the most recent election, this study asks: Are voting preferences predicted by personality traits, and if so, does personality become the basis for new ideologies? Specifically, how are perceptions of self (e.g., in-group identification, trust, paranoia, dogmatism and self-efficacy), understanding of others (e.g., authoritarian aggression, ambivalent sexism), perceived media realism and consumption, and cognitive style (e.g., need for cognition, evaluative consistency) related to voting behavior? Two hundred fifty college-aged, first time voters will complete an online survey comprised of existing personality trait scales and voting behavior questions. The implications of personality predictors on voting behavior will be analyzed within the framework of Ellul’s sociological propaganda. In a democratic political system, political ideology should transcend personality differences; if personality traits are found to predict voting preferences in the recent election, this is a serious concern. The implications of personality driving political ideology, and risks of susceptibility to direct propaganda will also be discussed.

Media Games: The Non-Athletic Framing of the 2016 Summer Olympic Games by the American Media

Olivia Skatrud

Mentor:

Dr. Marissa Doshi
Communication

This research was supported by an Undergraduate Research Grant made available through the Hope College Advancement Office

This project aims to understand how American media framed the residents of Rio de Janeiro in their non-athletic coverage of the 2016 Summer Olympic Games. Previous research conducted on media coverage of Olympic Games has approached the subject with a wider lens, merely mentioning that “other issues” are covered in addition to athletics. In contrast, this study adopts a narrow lens to unpack the cultural impact of the 2016 Olympics beyond athletics. Specifically, a qualitative textual analysis of new articles from June 2016 to August 2016 was conducted to understand the frames used to discuss the impact of the Games on the residents of Rio de Janeiro.

Framing theory suggests that media shape how audiences understand topics. Although analysis is ongoing, preliminary results indicate that there is an even distribution of articles that prioritized how Rio de Janeiro’s cultural issues were a detriment to the Olympic Games and articles that centered on the well-being of the residents of Rio de Janeiro. Further, co-cultural theory will be used to analyze the quotes of Rio’s residents in the news articles to understand the communication strategies used by residents to articulate their opinion of the Olympics. The results from this analysis will aid in understanding the attitudes of Rio’s residents towards the Olympic Games and their government. Based on the literature, I expect that the residents of Rio de Janeiro will use communicative practices of emphasizing commonalities, developing positive face, avoiding, communicating self, and gaining advantage.

Racial Discourse of 4chan.com

Parker Weaver

Mentor:

Dr. Marissa Doshi,
Communication

This research analyzes the racist discourse on the website 4chan.com. With the popularity of the website rapidly increasing and the seeming increase in overt racism in our supposedly post-racial society, especially on social media sites, the study seeks to find out what people on 4chan post when they have the option of anonymity. The sense of anonymity on the website theoretically will allow people to post things not directly attached to their name, since they are in a crowd and not easily identifiable. Beyond this, given how incredibly polarizing the most recent election was for America, the links between race and politics deserve further attention. In the study, I coded multiple posts for how the site treats several different racial groups. I look at whether or not racial slurs were present for the various groups, and if so how often they are mentioned. Overall the results showed that there exists racist discourse towards Middle Eastern and Black people. Future research should explore if users actually believe what they are posting on the website and whether or not this discourse is seen elsewhere on the internet.

The Effect of Maternal Work Hours on Children's Mental Health

Trevor Barker

Mentor:

Dr. Sarah Estelle,
Economics

In the United States only 12 percent of U.S. workers have paid family leave benefits from their private employer (U.S. Department of Labor). With the labor force participation rate of women with young children (under three years of age) increasing, from 34.3 percent in 1975 to 61.4 percent in 2015, this raises the question of the consequences of working mothers on young children. If maternal employment reduces the quantity or quality of interactions with her child, there may be unintended negative consequences for a child's mental health. Alternatively, employment may increase maternal fulfillment or provide benefits such as increased medical care, which may improve child well-being. This research examines the effect of maternal work hours during early childhood on the child's mental health later in life. Data from the National Longitudinal Survey of Youth 1979 and the accompanying child supplement allow for a family fixed effects strategy that will account for unobservable family-specific characteristics that would otherwise confound the effect this research aims to estimate.

Do More Lenient Gun Laws Reduce Criminal Activity? The Impact of State Concealed Weapon Laws on Crime

Joshua Groenhof

Mentor:

Dr. Sarah Estelle,
Economics

From 2005 to 2015, state laws nationwide have made it easier, on average, for individuals to carry a concealed weapon. During the same timeframe, both violent and property crime rates have generally decreased with the exception of violent crime rates in 2014 and 2015 which increased. If these trends are related, it may be that where concealed weapon laws are more lenient, would-be victims are more likely armed, decreasing the expected benefit of criminal activity. Alternatively, if concealed weapons are easier for perpetrators to carry, crime may increase in number and/or severity. Previous economic studies have considered the impact of concealed weapon laws on crime, but they fail to address the full variation of laws across states and time with respect to concealed carry permits. While the literature suggests that more lenient gun laws reduce crime, it is not clear whether this effect is monotonic (i.e. always increasing or always decreasing). Therefore, this research analyzes the heterogeneous effects of all four types of concealed weapon laws—no-issue (nobody can carry), may-issue (must provide a reason for the license), shall-issue (must pass basic requirements), and right-to-carry (no license needed)—as part of an overall objective of identifying an optimal concealed carry law with respect to resulting crime rates. Using state fixed effects as well as crime data from the FBI Uniform Crime Report, demographic and socioeconomic data from the US Census Bureau, and concealed weapon laws of all fifty states during 2005 to 2015, this research will analyze the impact concealed weapon laws have on crime, allowing for further heterogeneity of effects by type of crime.

Does Debt Discourage Marriage Early in Adulthood?

William Harrison

Mentor:

Dr. Sarah Estelle,
Economics

As the costs of higher education in the United States increase, young adults are entering the workforce with increasing levels of debt. According to the Pew Research Center, college graduates in 2008 borrowed 50 percent more to obtain a bachelor's degree than graduates in 1996. Over the same time, marriage rates among young adults have decreased, with one in five adults age 25 or older in 2012 reporting having never been married (Pew Research Center) compared to one in ten in 1960. This research aims to determine whether increasing indebtedness due to student-loans is a causal factor in the increasing delay in marital formation among young adults. A large literature establishes a variety of benefits conferred by marriage including health and financial benefits to those directly involved and socially desirable outcomes for children born with and reared by two parents. Using data from the National Longitudinal Survey of Youth 1997 and a propensity score matching model, this research finds that debt does not have a negative relationship with marriage early in adulthood, but these findings are likely subject to positive omitted variable bias.

Financial Habits among the Faithful

Karl Heusinkveld

Mentor:

Dr. Sarah Estelle,
Economics

This project examines how relative religiosity affects pecuniary conduct by examining how highly-religious individuals save income in comparison to the less religious. Humility and non-material satisfaction are often fundamental practices in the religious lifestyle, therefore consumption may be less among the religious. I examine where the savings difference is directed, and if savings accounts are larger among the religious due to decreased consumption. I find that while in most measures religious and non-religious individuals do not differ in their savings behavior, those religious in their youth are more likely to invest into homeownership.

Do Breadwinners Create Biased Households? The Effects of a Breadwinner's Gender on Investments in Sons versus Daughters

Nathan Morales

Mentor:

Dr. Sarah Estelle,
Economics

This research examines the effect the gender of the household breadwinner has on his/her investment (time, money, etc.) towards his/her children. More specifically, my model allows for gender to influence parental investment in families of varying child gender proportions differently. This relationship is of major interest because results could indicate the direction of family structures, gender roles, the gender wage gap, and the future composition of the work force. This study aims to determine whether or not a slight increase in recent female breadwinners could lead to increasing rates of female breadwinners in the future. If mom breadwinners particularly influence girls, then that increases their likelihood of becoming breadwinners themselves. Data from the Panel Study of Income Dynamics will be used to conduct the empirical analysis while a role model theory provides the basic theoretical model from which this study is conducted. In households with all sons, having a female breadwinner has a negative impact on both parents' weekly hours of childcare. There is no evidence to suggest that fathers invest less in daughters, but there is some suggestion that both parents prefer to invest in daughters.

Do Ridesharing Services Affect the Congestion of Urban Transportation?

Paul Nelson

Mentor:

Dr. Sarah Estelle,
Economics

With rapid advancement in smartphone usage has come the exponential growth of ride-sharing applications such as Uber and Lyft. These applications offer an alternative to the taxi industry, which in most cities is highly regulated. While taxi services are restricted in the prices they can charge and the number of vehicles they operate, ridesharing services need not apply for this strict licensing. Using the technology of a smartphone application, Uber's system of matching drivers and passengers offers an innovative way to hail a ride, with Uber claiming to complete over one million trips per day in the United States, potentially simplifying the process. Furthermore, as rapid urbanization has increased the population density of many U.S. urban areas, cities are pressured to rework their transportation networks to supply the increasing demand for public transportation, a gap ridesharing services have potential to fill. While ridesharing services offer a supplement to the transportation market including taxis, buses, personal cars, and light rail systems, an argument prevails that ridesharing services have increased traffic congestion in major cities. This research examines traffic trends in 100 U.S. cities after the implementation of Uber, which represents a majority of the ridesharing market, and the effect of Uber on road congestion. Using a fixed-effects regression model, I conclude that ridesharing services are associated with increases traffic congestion, but this result is sensitive to the inclusion of city and year fixed effects.

Up with Uncertainty, Down with Demand: How do Information Shocks Impact Automotive Purchasing Behavior?

Hadley Roy

Mentor:

Dr. Sarah Estelle,
Economics

*Special thanks to Drew Winter
at wardsauto.com.*

As a result of an information shock, when new consumer information becomes available in a market characterized by information asymmetry, the consumer must alter his purchasing behaviors in light of that new information to effectively maximize utility. Understanding these changes in purchasing behavior allows firms to react more proactively when information shocks occur, which could lead to more effective profit maximization through reduced forecasting errors and optimized resource allocation. When third-party ratings—such as EPA tests of automobile emissions or lab results for nutritional supplement purity—are called into question by an information shock, the market may respond to the new information on the particular good, but also with increased uncertainty about related products. This research examines vehicle sales data to ascertain the impact of an uncertainty-increasing information shock on a particular vehicle make on sales across brands and automotive segments. The revelation through routine re-testing in 2015 that Volkswagen AG diesel emissions were inconsistent with EPA test results provides the random variation necessary for a modified difference-in-differences strategy using interaction terms to identify the direct effect of the information on diesel vehicle sales for Volkswagen AG. Indicators for country of origin, brand, fuel type, and vehicle category allow for the evaluation of spillover effects generated throughout the industry as a result of the increased uncertainty. The analysis concludes that Volkswagen AG diesels and other non-Volkswagen AG, German diesels experienced a statistically significant decrease in monthly sales volume as a result of the information shock. The impact on non-German diesel vehicles, non-diesel Volkswagen, and other German non-diesel vehicles is statistically indistinguishable from zero.

The Impact of Diversity on Dropout Rates at the School District Level

Matt Sandgren

Mentor:

Dr. Sarah Estelle,
Economics

The 1954 *Brown v. Board of Education* ruling determined that the notion of “separate but equal” schools for blacks and whites was unconstitutional, and desegregation plans were put in place soon thereafter. Current desegregation programs are designed to send students, generally underrepresented minorities, to schools in districts with a large population of non-minority students. Angrist and Lang (2004) find for one suburban, majority white district that test scores were unaffected by the presence of additional underrepresented minorities. However, the effect of desegregation on dropout rates at the district level is less clear. Using school district-level data from the U.S. Department of Education’s Common Core of Data (CCD), an annual survey of approximately 18,000 public schools districts nationwide, this research aims to determine the relationship between the diversity of a district and its dropout rate.

The Impact of Advanced Maternal Age on the Young Adult Outcomes of the Next Generation

Genevieve Sponseller

Mentor:

Dr. Sarah Estelle,
Economics

According to the National Center for Health Statistics, from 1970 to 2015, the average age at first birth in the United States increased from 21.4 to 26.5 years (Center for Disease Control and Prevention, 2016). To learn what this trend means for the next generation, this research estimates the relationship between advanced maternal age and several young adult outcomes. Specifically, it considers the outcomes of educational attainment and health behaviors, including alcohol consumption and drug and smoking behaviors. This study uses nationally-representative panel data to conduct the analysis, which allows for siblings to be matched and compared. To discover the causal relationship between delayed motherhood on a child’s young adult outcomes, this research utilizes both sibling fixed effects and instrumental variable methods. These approaches account for otherwise unobservable characteristics of a woman that might influence both a mother’s decision of when to have children and her child’s young adult outcomes.

Females Have Fewer?: The Effect of a Manager’s Gender on Number of Children

Julia Toren

Mentor:

Dr. Sarah Estelle,
Economics

As female labor force participation rates have risen, the fertility rate in the United States has declined, reaching an all-time low of 62.3 births per 1000 women in 2016 (Lu et al. 2015; Rossen et al. 2016; U.S. Department of Labor 2015). If working women are limiting their family size with their careers in mind, this could indicate obstacles or societal expectations that discourage women from combining large families and successful careers, a trade-off that may differ from men. This research explores the gender differences in the number of children among those in management level positions. Extant literature suggests children significantly impact a woman’s labor market behaviors and wages; yet, there is limited analysis on how work and family decisions affect a woman’s family size and how that contrasts to a man’s, specifically among business professionals in the United States. Using individual-level data from the National Longitudinal Survey of Youth 1979 (NLSY79), I employ econometric techniques to isolate the effects of gender on family size among managers. Data on attitudes toward gender roles and ideal family size control for some of the selection bias and non-randomness present within the selected sample of those in management positions, yielding results that contribute to the evaluation of work and family life among male and female professionals.

Putting “Interactive” Back in Interactive Journals

**Rebecca Buth
Megan Jacobs**

Mentor:

Dr. Susan Brondyk,
Education

Websites like Pinterest and Teachers Pay Teachers have contributed to the recent popularity of interactive journals in classrooms, yet there seems to be considerable discrepancy as to the meaning of “interactive.” This qualitative study explores the interactive nature of these journals, by analyzing how teachers in one local elementary school use interactive journals in a variety of content areas (English Language Arts, Science and Social Studies). Our findings describe the ways that teachers modify/create interactive journals for the purpose of learning, offering new ways for students to learn through interactions with both the teacher and the content. In particular, we identify multiple ways that teachers promote learning by connecting students and ideas.

Rock, Paper, Scissors, iPads: A Qualitative Study of the Choices Kindergarten Children Make When Composing Texts

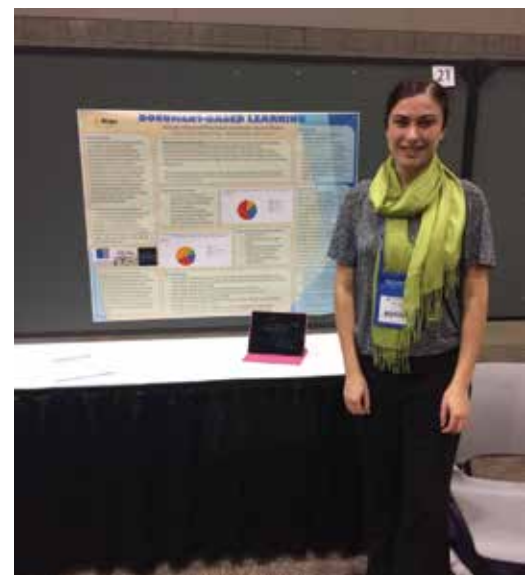
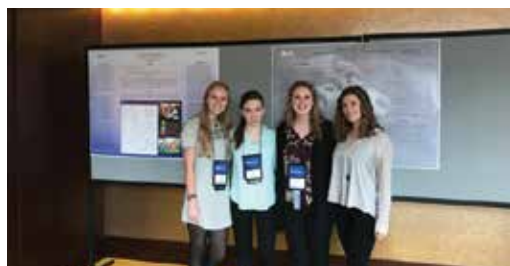
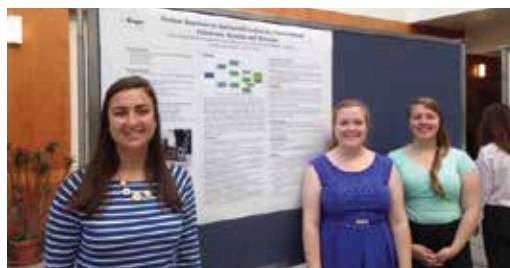
Alexandria Hutchison

Mentor:

Dr. Tony Donk
Education

The Common Core State Standards (CCSS) indicate that kindergarten students will: With guidance and support from adults, explore a variety of digital tools to produce and publish writing, including in collaboration with peers (CCSS.ELA-LITERACY.W.K.6). While this goal is clear, the professional literature stating how children will attain the requisite skills for reaching it is less so. This study adds to this emerging body of work. Specifically, our research explores opportunities and conditions for skill attainment prior to entering kindergarten and how these may influence students’ attitudes, comfort, and facility with digital tools for writing compositions as they enter kindergarten. We further explore how school-based access to, and modeled uses of, digital technology impact the choices kindergarten students make in the selection of tools for writing – namely paper and pencil or digital devices. In short, this study describes what teachers need to know about the digital influences on young learners, as well as how to match young learners with appropriate pedagogy for digital writing as they enter school.

*This research was supported by
a grant from the Hope College
Frost Research Center.*



A Middle School English Language Arts Teacher's Transition to Integrated, Project-Based Learning

Regan Jekkals
Katherine Supanich
Lara Iaderosa
Julie Isola
Carly Sommavilla

Mentor:

Dr. Stephen C. Scogin,
Biology and Education

In the past, subject integration efforts have focused primarily on coupling science with other subjects such as technology, engineering, and mathematics (i.e., STEM). However, recent initiatives seek to broaden integration of traditional STEM subjects with the fine arts (i.e., STEAM). Locally, a rural middle school has started a STREAM school program (with the "R" representing Reading) that includes the integration of STEM components, the arts, and English language arts (ELA) in a project-based learning environment. Although integrating ELA in STEM contexts offers many benefits including increased science content knowledge (Bradbury, 2014), the process can prove difficult for teachers. The purpose of this research is to investigate the trials and triumphs of an ELA teacher's transition from educating in a traditional setting to educating in the integrated STREAM program. Using case study methodology (Yin, 2014), this study tracks the successes and challenges of an experienced teacher who transformed the traditional ELA curriculum into an integrated, project-based learning curriculum. Data were collected from interviews with the teacher and analyzed using grounded theory (Strauss & Corbin, 1990). Furthermore, a framework was developed to describe and understand her experience. The results of this case study inform educators about the obstacles of ELA integration in STEM, and how these obstacles can be overcome.

Insight on Behavior Management Competencies from the Field of Special Education

Claire Kenyon

Mentor:

Dr. Jane Finn
Education

This research was funded by the Hope College Frost Research Center.

Previous research shows that a challenging area that keeps emerging for beginning teachers is maintaining order in the classroom or competent behavioral management skills. In special education, classroom management is complex. This extra layer of complexion is due to additional federal legislation including specific assessments and formal behavioral plans that must be completed on special education students. Studies note that shortages of special education teachers can be linked to behavioral management problems that cause burnout in the special education field. However, there is very limited research from special education practitioners and administrators in the field focusing on beginning behavior competencies. To fill this gap, a survey was completed by over 150 Michigan educators and administrators to identify those skills and practices necessary for effective behavioral management in the special education classroom. Questions included aspects of pre-service training, behaviors commonly seen in the classroom, as well as professional development opportunities available to practicing teachers. Statistical methods that were used include descriptive statistics, and ANOVAs. The results will inform principals, district administrators, and mentor teachers on the topics for continued professional development of first year special education teachers as well guide the training for the pre-service teacher.

I Get By with a Little Help from My Friends

Caitlin Maas
Emma Fowler
Taylor VanRemmen

Mentors:

Dr. Jane Finn
Education

Dr. Libbey Horton
Education

A qualitative study was completed to find if transition related skills of the young adults with intellectual disabilities improved while living for five years at the Friendship House. The Friendship House is a special dorm where individuals with intellectual disabilities live side by side with graduate students. Each of these young adults with intellectual disabilities were interviewed with an instrument that aligned with the Individuals with Disabilities Education Act (IDEA) entitled the Transition Planning Inventory (TPI). Findings from the TPI show that living at the Friendship House has helped these individuals improve their IDEA transition related skills of employment, home living, recreation/leisure and community participation. Areas of continual improvement include self-determination skills and social skills. Overall, the individuals with intellectual disabilities have grown in their IDEA transition related skills while living in this unique dorm.

Student Autonomy in a Nontraditional Middle School Classroom: How Do Students Handle Freedom?

Katherine Supanich
Carly Sommavilla
Julie Isola
Lara Iaderosa
Marissa Marks
Sara Erxleben

Mentor:

Dr. Stephen C. Scogin,
Biology and Education

This research was supported by the Hope College Biology Department and the Jacob E. Nyenhuis Faculty Development Grant Program.

STREAM School is a nontraditional, project-based learning program at a rural middle school in western Michigan. The program promotes high levels of student autonomy, which has been shown to lead to higher levels of engagement in projects (Bowman, 2011). In order to obtain a holistic understanding of students' experiences in the seventh-grade STREAM program, this research utilized a convergent-parallel mixed methods design (Creswell & Plano-Clark, 2011). Qualitative data were collected from face-to-face interviews with 51 seventh-grade students and analyzed using grounded theory (Strauss & Corbin, 1990). Quantitative data were taken from 50 students' pre-post responses to the S-STEM Survey for Middle and High School (S-STEM; Friday Institute for Educational Innovation, 2012) and the Intrinsic Motivation Inventory (IMI; Ryan, 1982). Paired-samples t-tests were run on the S-STEM and IMI survey data to determine if students' attitudes and motivations changed over the course of the school year. Furthermore, scores from the Michigan Student Test of Educational Progress (M-STEP) were collected and analyzed using independent-samples t-tests to compare STREAM (n = 60) and non-STREAM (n = 138) students. Ultimately, researchers found that students frequently mentioned the autonomous atmosphere of STREAM School when describing their experiences. For some, the transition to a highly autonomous environment was difficult and required teacher scaffolding. However, analysis of standardized test scores demonstrated that STREAM students either outperformed or were right on par with their peers in math, science, and language arts. These findings indicated the program was not detrimental to students' mastery of mandated content standards. In addition, the S-STEM and IMI surveys indicated that students' attitudes toward math improved after their STREAM School experience, and students felt most motivated by the projects that offered them the most freedom and choice. This study addresses a major issue in modern education: how to provide students with freedom in their learning while keeping them deeply engaged in the material and performing well on standardized tests.

Improved Reading Scores: Does Gender Matter?

Michael Wurster

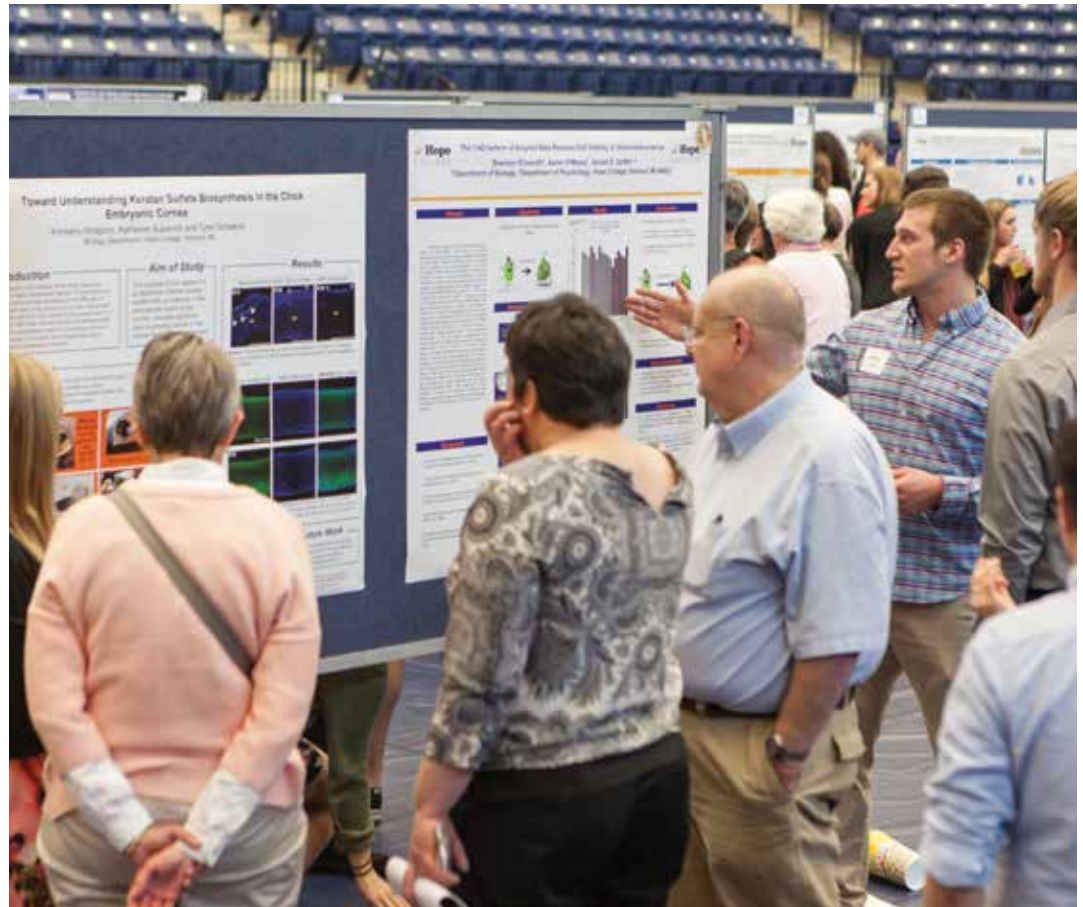
Mentors:

Dr. Jane Finn,
Education

Dr. Vicki-Lynn Holmes
Education and Mathematics

Dr. Libbey Horton
Education

Previous studies have shown that females score higher than males in reading achievement tests. Girls tend to have a more positive attitude towards reading as well as being more active readers than boys (Coles & Hall, 2002; Sainsbury & Schagen, 2004; Logan & Johnston, 2009; Hall & Coles, 1999; Logan & Johnston, 2009). To see if this pattern held true for the students attending the Children's After School Achievement, or CASA, the Brigance Comprehensive Inventory of Basic Skills (CIBS II) was conducted. CASA students were given the CIBS II pretest subtests of word recognition, oral reading, and reading comprehension in Fall 2015 and the CIBS II posttest subtests were administered in Spring 2016. Descriptive statistics, paired and independent t-tests, and an ANOVA were conducted to determine which gender performed better in the subtests along with which gender showed greater improvement in reading. Results showed that overall all students had significant improvement in all subtests. For males, there was significant improvement in word recognition and reading comprehension; while for females, there was significant improvement in word recognition and oral reading. When subtest scores between the male and female students were compared using an ANOVA there was a significant difference between the scores of the males and females in word recognition and reading comprehension, but there was no significant difference in oral reading scores. These results will be discussed and possible theories will be given during this presentation.



The Effect of Three Different Exercise Prescriptions on Daily Physical Activity

Haleigh Locke
Paige Recknagel
Alex Apostoleris

Mentors:

Dr. Brian Rider,
Kinesiology

Dr. Maureen Dunn,
Kinesiology

Numerous studies have shown the effectiveness pedometers have on increasing individuals' daily physical activity (PA) levels. A large part of their effectiveness lies in their ability to monitor daily activity and provide motivation for an individual to exercise. **PURPOSE:** To examine the impact of various exercise prescriptions (3,000 more steps, 30 min extra per day, or 1500 steps more 2 times daily) on participant's PA, measured via pedometer. **METHODS:** Eighteen insufficiently active Hope College students participated and were randomly assigned one of four prescription groups. Groups included an additional 3,000 steps (A), 30 added minutes of PA (B), two bouts of 1500 steps (C), and a no-prescription control group (D). Each participant completed a four-day baseline period recorded by the pedometer. Pre- and post-tests measured weight, height, stride length, resting heart rate and resting blood pressure. The following two weeks included daily logging of data and weekly meetings with investigators to record the pedometer data. **RESULTS:** A 1x3 repeated measures ANOVA and paired t-tests analyzed the study's data. The groups' average daily steps (including baseline, week one and two) were: A (7290.0 ± 4118.7), B (6505.2 ± 4726.0), C (5665.7 ± 6002.6), and D (8035.5 ± 4932.3). The average daily aerobic steps were: A (1324.9 ± 2502.4), B (1216.0 ± 3657.4), C (387.3 ± 1052.9), and D (1529.6 ± 2742.5). The control group was significantly different between their baseline and 2nd week of prescription ($p=0.04$). No other comparisons between groups or overall were significant ($p>0.05$). **CONCLUSION:** No prescription appeared to significantly increase a person's daily PA. Prescriptions did keep participants' daily steps consistent; whereas, the control group significantly decreased in daily PA.

Effect of Caffeine on Anaerobic Cycling Performance

Katerina Buck
Caitlyn Campbell
Erica Theros
Elizabeth Lane

Mentors:

Dr. Kevin Cole,
Kinesiology

Caffeine is one of the most highly accessible and conventional supplements on the market, and is especially popular in young, non-elite populations. Previous research has been equivocal regarding the potential ergogenic effects of caffeine on exercise performance. This study was designed to elucidate the debate in the scenario of untrained individuals performing anaerobic exercise. Specifically, the purpose of this study was to examine the effects of a caffeine supplement on the anaerobic cycling performance of college students. In a double-blind crossover design, experimenters examined untrained individuals ($n=11$) over the course of three consecutive Wingate anaerobic cycling tests, separated by short periods of rest. Each participant underwent a familiarization trial of the protocol followed by two experimental trials; one in which a caffeine supplement was ingested 30 minutes prior to exercise, and one in which a placebo was ingested. It was hypothesized that participants would show improved anaerobic performance following caffeine supplementation when compared to placebo consumption. Significant results would permit the recommendation of caffeine as an ergogenic aid to enhance anaerobic performance in college students. This study is in progress, and results will be available during the Celebration of Undergraduate Research.

How Long is Too Long? A Concussion Overview

Taylor Carter

Mentors:

Tonia Gruppen MS, AT,
ATC,
Kinesiology

The many signs and symptoms that are associated with concussions can be both qualitative and quantitative. Scientists today are still in the works of gripping the many causes, variations of treatment protocols and redesigning of sports equipment to make our athletes safer and more aware of concussions and their severity. The literature is constantly changing and evolving in a direction towards safety, protection and knowledge of the processes of the brain activity once a concussion occurs. Some studies focus on medical theories or neurocognitive testing while others may focus on consensus statements and what linking professions have found out. The research question of this project focuses on whether or not this athlete's concussion signs and symptoms should be put to question for the longevity of the injury. It also focuses on if something more underlying is taking place in this particular case that could make some concluding statements about concussions in general. A case study took place where the athlete's mechanism of injury, diagnostic processes, and treatment protocols were examined as well as extracurricular and recreational activities to come up with learned results. This research examines the case information as well as the physiological links to altitude and concussions and the supporting literature.

The Effect of Lower Extremity Fatigue on Balance in Dancers, Cross-Country Runners, and Non-Athlete College Students

Mackenzie Govier
Courtney Kachlik
Courtney Tuinier

Mentors:

Dr. Maureen Dunn
Kinesiology

This study was designed to compare the effect of lower body fatigue of individuals (n=27) from different athletic backgrounds on static balance. Participants included dancers (n=8), cross-country runners (n=9) and non-athletes (n=10). It was hypothesized that the dancers would have greater balance after fatigue compared to the cross-country runners and non-athlete college students. This hypothesis was based on the dancer's physical training. Each participant was familiarized with the study methods before beginning experimental trials which included 2 identical sessions. During each session, participants performed a tandem stance balance task on a force plate for 20s with eyes opened and closed prior to cycling to fatigue on a stationary cycle ergometer. The balance tasks were then repeated. Postural sway path length (cm) and area of the 95th percentile ellipse (cm²) were assessed. Fatigue resulted in significant decreases in balance in all groups for postural sway path length (pre-eyes opened path length: 99.18±2.87 cm, post-eyes opened path length: 113.67±5.89 cm, p=0.006; pre-eyes closed path length: 161.44±9.82 cm, post-eyes closed path length: 184.87±14.71 cm, p=0.021), but not area of the 95th percentile ellipse (p>0.05). Furthermore, there were no interactions between groups, suggesting that all participants balance scores responded to fatigue similarly, and dancers did not have better balance than cross-country runners, and non-athletes as hypothesized.

The Effect of Beetroot Powder Supplementation on Intermittent Cycling Performance

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Mentors:

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We examined the effect of beetroot powder (BR) supplementation on intermittent cycling performance. BR powder is a concentrate made out of beets which is rich in nitrites and nitrates which have been shown to improve blood flow. Prior studies have reported an ergogenic effect of BR supplementation on endurance and intermittent exercise performance; however, these findings are not conclusive and further study is warranted. The purpose of this study, therefore, was to determine the effect of BR powder supplementation on intermittent cycling performance in college students. Our hypothesis was that BR powder supplementation would improve intermittent cycling performance compared to a placebo powder as measured by increased mean power output over a series of twelve 6 second sprints. Twelve Hope College students took part in the study. Participants were familiarized with the cycling protocol prior to performing experimental trials, which consisted of twelve 6s maximal cycle sprints each interspersed with 24s of passive rest. Prior to each experimental trial, participants ingested BR powder or placebo for 3 consecutive days in a double-blind counterbalanced manner. Powders were mixed with 6-8 oz of water or juice for ingestion, and ingestion was supervised by student researchers. The final dose was ingested 30 minutes before cycling. Each dose of BR contained 6 mmol Nitrates, while the placebo powder was nitrate-free. This study is ongoing, and results will be available during the poster celebration.

Aerobic Training with the Elevation Training Mask

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Dion Goliday
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Mentors:

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Altitude training simulators have been produced with the goal of providing the benefits of altitude training to a variety of populations. One altitude-simulating device is the Elevation Training Mask 2.0 which uses a series of inhalation and exhalation valves to decrease the volume of airflow in and out of the mask with a single breath. This study was designed to see if High Intensity Interval Training (HIIT) sessions (10x 60 seconds) twice a week, along with a single day of steady state exercise (30 minutes) per week on a cycle ergometer with the Elevation Training Mask 2.0 (MASK, n=5) would significantly decrease oxygen deficit, decrease time to VO₂ steady-state, and improve oxygen economy at the onset of submaximal exercise compared to training without the Elevation Training Mask 2.0 (CON, n=4). It was hypothesized that greater stress on the respiratory system, from wearing the Elevation Training Mask 2.0, would result in greater oxygen efficiency and utilization as marked by oxygen deficit, time to VO₂ steady-state, and VO₂ needed to exercise at a set intensity. Following 4 weeks of training significant improvements were seen in oxygen deficit between MASK and CON (MASK: 410.68±66.08, CON: 459.01±73.87 ml/kg/min, p=.022). Significant differences were seen in time to VO₂ steady-state with training for all participants (pre: 77.33±20.38, post:56.89±11.92 seconds, p=0.015); however, there were no differences between groups post-training (MASK: 67.40±6.66, CON: 66.75±7.45 seconds, p= 0.95). No differences were found in VO₂ demand with training (pre:34.98±3.87,post:34.04±3.21 ml/kg/min, p= 0.436), or between groups. Evidence suggests a decreased oxygen deficit at the onset of submaximal exercise following aerobic training with the Elevation Training Mask 2.0.

Validation of the Omron HJ-323u Pedometer Worn on the Hip, Wrist, and Chest for Measuring Physical Activity in College-Aged Students

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Activity trackers, pedometers and other technological devices have recently become a popular way for individuals to monitor the amount of physical activity performed daily. Many studies have recently been conducted to determine the validity of various pedometers when used in different stages of physical activity. The purpose of this study is to test the accuracy of the Omron HJ-323u activity tracker by determining whether this particular model of activity tracker can accurately count how many steps someone takes while moving at different speeds. Furthermore this study will determine if there is a relationship between a participant's body mass and the accuracy of steps recorded, as well as determine if there is a relationship between steps recorded and placement of the activity tracker. 30 college students' steps were recorded as they walked on a treadmill at speeds of 1.0, 3.0, and 5.0 mph with activity trackers attached at both wrists, both hips, and the chest. Participants also walked twice around a 200m loop while researchers recorded their steps. It was hypothesized that activity trackers placed on the dominant side of the body would record more valid results at all speeds than trackers on the non-dominant side or the chest. Significant results would validate the Omron HJ-323u activity tracker as well as allow the tracker to be used to confidently during exercise to measure performance. This study is ongoing, and results will be available during the poster celebration.

Olecranon Fracture Reduction: A Case Study of an Olecranon Fracture Fixation in a Recreational Cyclist

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The elbow is made up of three bones, the radius, ulna, and humerus. The bony prominence on the back of the elbow is the olecranon process. This olecranon is needed to stop the arm from extending backward. Fractures to the olecranon process of the elbow account for approximately 10% of all adult upper extremity fractures. These fractures are most often seen in active and elderly populations resulting from high-energy trauma or low-energy falls, respectively. In those living an active lifestyle this can be a debilitating injury potentially leading to less range of motion. This alone can inhibit athletes in the functional movement required for sport as well as daily activities such as pulling a door or picking up a backpack. A 27-year old female recreational cyclist was participating in a 28-mile road race. The athlete was racing at 32 miles an hour when her front tire was struck on the left side, sending her body and the bicycle to the right. She was triaged by a first aid responder and taken to the nearest hospital for further trauma consultation. At the hospital, she had x-rays and was immediately sent to the nearest university hospital. The patient was treated for a comminuted, displaced, stable olecranon fracture of the elbow with 2 plates and 7 screws as well as severe road abrasions. The two main types of olecranon fracture classifications are Shatzker and Mayo. These aid in describing the type of fracture pattern and stability present in the compromised joint. Most fractures are treated surgically through an internal fixation. This method yields the greatest results especially in the active population. Many will have success with a surgical fixation; however, frequently loss of full extension of the elbow is seen in long term outcomes.

The Effects of 5 Weeks of Pull-up Training with Fat Gripz™ Bar Attachments on Grip Strength and Shot Speed in Collegiate Men's Lacrosse Athletes

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Using wider bar diameters during “pulling” exercises (such as pull-ups), may activate muscles in the forearm influencing grip strength. Fat Gripz™ bar attachments, devices used to increase bar diameter, were used in this study. The purpose was to examine whether performing pull-up training using Fat Gripz™ (FG, n=8) would improve grip strength, 1RM lat pull-down, pull-ups to failure, and shot speed of male collegiate lacrosse players compared to using a standard diameter pull-up bar (CON, n=6). It was hypothesized that dependent variables would have a greater increase in the FG group than the CON group due to enhanced forearm muscle activation. All participants performed 3 sets of supervised pull-ups to failure 3 times/week for 5 weeks. Following training pull-ups to failure increased for both groups (pre:9.64±3.65, post:16.57±7.32, p<0.001); however, there was no significant difference between the CON and FG groups (p=0.131). Similarly, all participants increased grip strength with training (Left grip: pre:40.07±5.69 kg, post:46.04±6.24 kg, p<0.001; Right grip: pre:41.93±5.41 kg, post:46.83±6.03 kg, p=0.005), 1RM lat pull-down (pre:167.71±6.45 lbs, post:183.75±5.95 lbs, p<0.001) and lacrosse shot speed (pre: 74.28±8.59 mph, post:78.61±7.18 mph; p=0.008) with no significant difference between groups (p>0.05 for all dependent variables). Interestingly, the FG group averaged significantly less pull-ups per set than the CON group over the course of the 5 week training period (CON: 10.23±1.29 reps/set, FG: 6.15±1.11 reps/set, p=0.034). Therefore, while our hypothesis that the FG group would improve to a greater degree with training than the control group was not supported, there is evidence to suggest that training with a wider bar diameter can result in similar performance improvements with less training volume. Further research is warranted to study the effects of resistance training with wide diameter bars.

Just another ACL Tear, or Is It?

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An ACL tear may present with complications during the rehabilitation process. This case examines one which might not be as common, a cyclops lesion. A 20 year-old collegiate football player three months into post-surgical rehabilitation experienced limited knee extension, anterior knee pain, an audible click with functional movements as well as decreased strength given his disposition. Timely recovery from an ACL repair is inhibited with these lesions due to the location and potential size of the structural deformity. A fibrous notch was evident upon further examination of this athlete approximately three months into his rehabilitation process through MRI imaging. Review of the revision, the presentation and complications of a cyclops lesion as well as progressive rehabilitation procedures are explained. This case also pursues the importance of patient and practitioner communication as well as the vigilance in detecting complications in what should be normal progression after ACL repair.

Is It Just an ACL Tear?

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As the anterior cruciate ligament (ACL) tear continues to be one of the most predominant injuries within athletics, sports medicine specialists have become fixated on the ACL injury at hand, such that we may be forgetting an array of underlying pathologies, leading to the question, “Is It Just an ACL Tear”? This case study explores several concurrent injuries, as well as follows a collegiate athlete who experienced an ACL injury with an associated Osteochondral Defect (OCD). When the ACL tears, compression between the knee’s articulating surfaces generates a shearing force of the hyaline cartilage, exposing the underlying subchondral bone in 70%–80% of ACL pathologies. These chondral defects have minimal healing potential due to the lack of vascularity, creating the risk for long term osteoarthritis. Various surgical procedures will be examined through subchondral drilling, abrasion arthroplasty, and in this case an induced microfracture with the goal to restore tissue by stimulating the metabolic healing process. The rehabilitation timeline will be explored in comparison with a general ACL protocol, along with the success rates. Through these shearing forces, meniscal tears coincide with approximately 85% of OCD pathologies and 60% - 70% of ACL tears, while rotational knee instabilities, more specifically a posterolateral instability prevails in about 72% of ACL injuries. Classifications of tears and specific rotational instabilities will be explored, as well as their treatment, rehabilitation, and outcomes. Whether it be an ACL tear, or another common pathology, we cannot assume every injury is the same. Every patient should be treated as a specific individual based on their symptoms rather than an injured body part.

Utilizing Core Stability in a Bankart Repair Rehabilitation

Katie Pimmler

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In the rehabilitation orthopedic injuries, having a whole body mindset is necessary for the full recovery of the athlete. As each part of the body is attached to the whole the effect of injury to one seemingly isolated area does affect the global system. This study was done around a case that entered rehabilitation after a Bankart Repair surgery. Innately, the glenohumeral joint sacrifices stability for enhanced mobility. The Bankart repair is primarily to repair any damage from the hypermobile humerus and tighten the capsule. Therefore, rehabilitation for this athlete is focused on progressing the stable use of the joint at the humerus as well as how the rest of the body works with the shoulder. The utilization of the lower core was specifically evaluated in the global strengthening process to investigate better rehabilitation engagement. Developing a dynamic core requires the upper body to position the trunk over the pelvis providing a foundation for optimal function of the upper and lower extremities. The throwing process is unique often to upper extremity on the dominant side and requires the build up, release, and control of power and torque in precise timing. Therefore, in the rehabilitation progression of an athlete with the need to strengthen instability in the his dominant arm, founding a strong core is of great importance. The pelvic floor was specifically evaluated due to the muscles’ role in upholding strength in the lower abdominals as well as stability in the pelvis and further down the kinetic chain. Engaging the muscles of the transverse abdominis, multifidi, and pelvic floor provides a direct foundation to the upper back musculature, providing mobility and stability to scapulothoracic and glenohumeral joints. As the athlete progressed through post surgical rehabilitation, areas of the shoulder, upper and lower back, and core were facilitated simultaneously, enhancing the patient’s return to play and overall function.

The Effect of the Simply Fit Board Training Program on Balance, Body Composition and Core Strength in College Students

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Ian Koziatek
Jacob Foster
Reginald Kushion

Mentor:

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The “Simply Fit Board” (SFB) is a product that has claimed to improve balance and strength with regular use. SFB training only requires a level surface, like carpet or a linoleum floor, and dumbbell weights with progression in training. Since the product is new, there is no existing research to support its claims; therefore, the purpose of this study was to examine whether or not 4 weeks of training with the SFB would improve balance, core strength and muscle tone, as the company claims it would. 15 students were assessed for static balance using the Star Excursion Balance Test and various two-legged stances on a forceplate. Ground reaction forces on the forceplate were recorded for 20 seconds with eyes open and 10 seconds with eyes closed. Body composition was measured using the Bod Pod, waist circumference, and 3 skinfold sites; the mid abdominal, mid thigh, and supraillium. Lastly, core strength was determined using the curl-up test to a 50 bpm metronome. Participants were matched to the exercise and control group based on gender and initial balance ability. The 10 participants in the exercise group met 3 times per week for a four-week period to undergo SFB training. Training occurred for 10 minutes the first week and reached 30 minutes at the end of the 4-week period for a total of 12 sessions. The control group (n=5) maintained habitual activity. We hypothesized that SFB training would increase core strength in the curl-up test and balance in both the star excursion balance test and force plate analysis. Significant results would provide evidence to support the claims made by the Simply Fit Board company that the board can serve as an effective mode for improving balance, and increasing core strength for this specific population. This study is ongoing, and results will be available during the poster celebration.

The Effect of Television Viewing on Psychological Variables and Running Performance

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BACKGROUND: Music has been shown to positively impact athletic performance during exercise. There is currently a dearth of knowledge on the effect another form of media, television (TV), has on specific psycho-physiological variables during exercise. Though recent research has shown that viewing self-selected TV programs can positively impact reported enjoyment of exercise, it is unclear as to what, if any, effect different types of TV programs would have on exercise performance. Therefore, the purpose of this study was to examine the effects of two types of video footage on running performance, ratings of perceived exertion, motivation, affect, arousal and exercise enjoyment when compared to a no-TV condition. **METHODS:** 10 college students completed a maximal exertion treadmill test at three separate trials while watching either nature footage, sports clips, or no TV. At each trial the subjects ran for 3 minutes at 10% and 20% below their ventilatory thresholds (VT), then ran for as long as they could at 10% above their VT. Both during and upon completion of each trial they completed various surveys aimed at discerning the psychological impact of the video footage. **RESULTS:** There were significant differences in reported enjoyment between the sports condition (84.3±11.9) and the no TV condition (68.6±17.2) (P= 0.009) (PACES). There were no significant differences in RPE between conditions at stage 1,2,3 or the end of the test. While there was a correlation between those who reported greater levels of PA per week and those who were “intrinsically” motivated towards exercise, there was no correlation between motivation type and reported enjoyment of exercise. Additionally, time until fatigue was not significantly different between conditions. **CONCLUSION:** This study confirms the results of previous research in that TV viewing during exercise does result in greater reported enjoyment compared to a no-TV condition. However, it does not positively or negatively impact performance.

Effects of Visual and Auditory Stimuli on Exercise Performance and Ratings of Exercise

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Auditory and visual stimuli are often used by individuals during exercise. Previous studies have found that such stimulation can increase exercise performance and enjoyment through distraction from feelings of fatigue and exertion. This study is being completed to determine the combined effects of auditory and visual stimuli, as compared to each alone or no stimulation, on various measurable outcomes of exercise. These measurable outcomes will include ratings of exercise enjoyment, internal (fatigue, exertion, etc.) or external (daydreaming, focused on surroundings) attentional attributions, peak and average heart rates, and distance cycled. Each participant will engage in moderate-intensity cycling on a stationary bike for four consecutive weeks, during which they will be exposed to four different conditions of stimulation: visual and auditory, visual alone, auditory alone, and no stimulation. The order of the conditions will be randomized for each participant, and the workload added to each bike will be tailored to each individual participant's body weight and aerobic capacity. This will be measured by a V02 Max test prior to the beginning of the experiment. Auditory stimuli will be popular music and visual stimuli will be the accompanying music videos. It is hypothesized that in the visual/auditory combined stimulation condition that the distance cycled and peak heart rates will be higher, the exercise will be rated more favorably, and attentional attributions will be more externally focused than with visual, auditory, or no stimulation. If the results are significant, it would be recommended that individuals utilize visual and auditory stimuli during exercise to improve their exercise performance and enjoyment. This study is in progress, and results will be reported at the Hope College Celebration of Undergraduate Research.



Assessment of Oxygen Deficit in Collegiate Runners During Steady State Exercise

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This research was supported by the Henderson Fund for Kinesiology Student Research and the Constantin Kinesiology Student Research Fund.

Oxygen deficit (OD) for the same absolute workload intensity decreases with aerobic training through improved aerobic metabolism and likewise increases with detraining. It is unclear if the amount of increase in OD with detraining is the same in middle distance (MD) and long distance (LD) runners and what training related OD changes occur in these groups with subsequent retraining.

In order to compare and contrast the changes in OD values of collegiate MD and LD runners which accompany a post-competitive season cessation of training and subsequent endurance retraining, fourteen members of the collegiate track team (7 MD and 7 LD) runners completed a steady-state treadmill test (SS) at their gender-specific mean 5k velocity (15.3 kph for females and 18.5 kph for males) at the conclusion of their track season followed by 3 additional SS tests at 2-week intervals. Participants did not train between SS1 and SS2 and performed identical prescribed training programs between SS2 and SS4. VO_2 steady state was identified as the breakpoint of the second phase of the OD curve. OD area under the curve comparisons were made using a 2x4 repeated measures ANOVA.

We found that MD demonstrated a significant decrease in VO_2 at SS pace over the 6-week study resulting in a reduction in their mean OD (6.4%) versus LD (-0.5%) ($P < .01$). Mean anaerobic contributions to reach SS were greater in LD than MD (36.9% vs. 32.2%) at the end of 4-weeks of retraining ($P < .01$).

In conclusion, there are differences in OD patterns that accompany both detraining and endurance retraining in collegiate MD and LD runners. LD runners were more aerobically challenged than MD to maintain SS velocity after detraining and may require a greater volume of anaerobic training than MD runners during the early retraining phase in order to retain a faster training pace.

A Case Study: Spinal Injuries of a Collegiate Football Athlete

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The human nervous system provides opportunities to experience so many positive sensations through smell, touch, and activity. However, when the nervous system malfunctions, intense negative sensations can override the positive experiences and cause miserable pain. Spinal stenosis is a condition where the spinal canal narrows and impinges upon the spinal cord causing radicular symptoms to travel throughout the body. Stenosis can be caused by genetic deterioration over time as well as through traumatic injury. Genetically, some individuals are predisposed to have deteriorating vertebral disks within their spinal column which can cause the nucleus pulposus to impinge on the spinal cord or spinal nerve roots. Impingement is also caused by general swelling or trauma within the spinal canal. Mechanisms of injury for traumatic incidents include high velocity neck extension, brachial plexus stretch, and repeated collisions with high amounts of force. This case study looked at a 19-year-old Division III male collegiate football player. After being involved in a larger collision, the athlete's arms would go numb, which made holding the ball and making an effective play increasingly more difficult. Initially, symptoms were tolerable and the athlete persevered. However, eventually the athlete's performance was affected enough where he was told to refrain from participating in football after the physician's diagnosis. His genetics as well as extracurricular activities created the perfect storm, which led to his diagnosis of cervical disk disorder with bilateral radiculopathy as well as neural foraminal stenosis of the cervical spine. Treatments to reduce symptoms include neural mobilization and cervical tension, transverse oscillatory pressure, strengthening of muscular stabilizers, and proper posture. Surgical intervention is required in extreme cases. More research is critical for determining better solutions for pain control as well as the potential for return to play for athletic individuals who want to participate in sport.

Where Are the Women?

Miche Andre

Mentor:

Dr. Marty Jordan,
Political Science

This research aims to uncover the reasons why there are fewer women that are elected to political office than men. Moreover, I seek to examine the American public's attitudes towards electing a female president. Using the 2012 American National Election Study, a national randomized survey, I plan to test the main factors that explain the respondents' support for female politicians.

Public Opinion and War in America

Gabrielle Barber

Mentor:

Dr. Marty Jordan,
Political Science

This research examines the American public's support of U.S. involvement in war. In particular, I explore the role that soldier casualties, economic development, and the length of war play on support for war efforts. Using these variables, I will test the correlation between them and the popularity of the war on the homefront, with the theory that the fewer the casualties and shorter the war, the higher approval rating of the war within public opinion.

Interest Groups Effect on CO₂ Emissions/Environment

Jake Birkhaug

Mentor:

Dr. Marty Jordan,
Political Science

This investigation looks to observe how the growing number of environmental interest groups in the United States has impacted the average amount of CO₂ produced in each state. This study aims to determine what factors render these groups either effective or ineffective at decreasing the amount of CO₂ pollution. The investigation will rely on several sources including two data sets that measure these values over the past 10 years. The end goal is to discover if interest groups really do make a significant difference when it comes to protecting the environment from human pollution.

What Effect Does Community Size Have on Individual Voter Turnout?

Arend Buitenhuis

Mentor:

Dr. Marty Jordan,
Political Science

In this research project, I explore what effect community size has on individual voter turnout? By looking at previous research done on both community size and other established factors of voter turnout—such as race, gender, income, etc—I will examine to what extent voter turnout is affected by community size.

Examining Changing Political Trust in America

Kiley Corcoran

Mentor:

Dr. Marty Jordan,
Political Science

Since the 1950s, the American public's trust in government has declined. Relying on public opinion surveys, this research examines what factors explain this erosion of trust. In particular, I assess two key factors that may explain this decline, including an individual's level of political interest and knowledge, and an individual's degree and type of partisanship.

Attitudes towards LGBTQ Rights

DeVante Cosby

Mentor:

Dr. Marty Jordan,
Political Science

This work will trace what factors explain shifts in American attitudes toward the advancement of LGBTQ rights. In particular, relying on public opinion surveys I explore the role that political ideology plays in explaining an individual's support for LGBTQ rights.

National Cybersecurity and Public Trust in Government

Brittany Evans

Mentor:

Dr. Jeffrey Polet,
Political Science

In an age of uncertainty and insecurity—where a lack of legislative precedent and the growing pains of globalization reign indefinitely—the issue of national cybersecurity gains saliency. However, as international actors attempt to navigate uncharted waters, private individuals remain vulnerable to the shortcomings of both the state and international community. Therefore, this study seeks to observe the impact of perspectives on national cybersecurity and public trust in government. The method includes statistical analysis on a former longitudinal study of public trust of government in the United States, which maps to dates of publicized threats to US national cybersecurity; another method includes data on self-described public awareness of the landscape of national cybersecurity threats.

Religion, Government, and Conflict

Dominic Ferrera

Mentor:

Dr. Marty Jordan,
Political Science

Religion and type of government (ie. Autocracy vs Democracy) often influence one another and religious values often become reflected in the government itself. These ideological differences may cause different states to become alienated and make conflict between them more probable than with a state that holds similar beliefs. My research project attempts to explore this relationship.

The Relationship between a Nation-State Being Land-Locked and Its Economic Development

Natalie Fulk

Mentor:

Dr. Marty Jordan,
Political Science

This research will look at the relationship between a nation-state being landlocked and its economic development. Based on the literature, my theory is that landlocked nation-states will have less economic development than coastal nation-states. Also, the more that a nation-state is landlocked, measured as the more countries around it and the farther away it is from the coast, the less economic development it will have. I will look at a dataset related to economic growth and compare countries to evaluate my theory.

Factors That Lead States to Raise Their Minimum Wage

Matthew Gentry

Mentor:

Dr. Marty Jordan,
Political Science

In a diverse nation of 50 states policy differences are commonplace. One of the biggest and most contentious policy variations is the minimum wage. Some states have simply left it at the federal level while others have drastically increased it. This study looks to dissect economic, political, and historical reasons that lead dozens of states to raise the minimum wage and cause other states to leave it alone.

A Case Study of Gender Based Violence in the United States with an Emphasis on Domestic Violence

Bany Guardado

Mentors:

Dr. Jeffrey Polet,
Political Science

Dr. Kendra Parker,
English

Women and men around the world face gender based violence (GBV), keeping in mind that this phenomenon is independent of place, culture, and religion. In America the cases of gender based violence becomes diverse as we have more variables to observe. Such variables are nationality, sexual orientation, and socio-economic backgrounds. For the purpose of this paper the researcher will focus on domestic violence in American society observing religious beliefs, legal system, and economic factors that come into play when discussing the matter of domestic violence. The paper will put the issue in the context of intersectionality and why this still continues to be an issue in today's time.

What Causes Terrorism?

Samuel Jansen

Mentor:

Dr. Marty Jordan,
Political Science

This research attempts to identify some of the causes of terrorism. I explore the levels of inequality, GDP, and the degree of democracy within a country and observe their influence on terrorist activity. I rely on the Global Terrorism Database, to discover the leading factor of terrorism.

Does Oil Really Influence the Probability of Foreign Intervention?

Katrin Kelley

Mentor:

Dr. Marty Jordan,
Political Science

It has been suggested that a disproportionate amount of the interventions by the United Nations organization occurs in countries that have valuable resources. This research attempts to examine relationship between countries which possess a valuable resource—in this case oil—and military intervention or actions by the UN. In particular, I explore the economic theory behind this research, namely that the UN gives preferential treatment to troubled areas of the world where a key global resource is located. While correlation does not imply causation, a positive result here would lend further evidence towards a more comprehensive analysis of this relationship. This research relies on the International Intervention Dataset, which is a collection of 1,083 observations on what determines military intervention and other actions by the United Nations.



Syrian Refugee Resettlement in the United States and Canada

Katelyn Kolker

Mentor:

Dr. Jeffrey Polet,
Political Science

The purpose of this paper is to examine the different factors that have led to Canada accepting more Syrian refugees than the United States. The conflict that began in Syria in 2011 has increasingly drawn international attention due to the escalating violence within the country. The conflict in Syria started as a branch of the Arab Spring uprising and escalated into an armed conflict after the government violently repressed protests for democracy. This armed conflict has caused a humanitarian crisis because Syrians have been forced to flee their homes due to persecution. The crisis in Syria has had an impact on the global scale because of security and humanitarian threats to the international arena. Specifically, Canada and the United States have been affected and in result have had to create policy to address the needs of the refugees fleeing from Syria. Both of the countries are similar in many ways but have different histories of immigration that have impacted their approach to the current problem with Syrian refugees. Prime minister Justin Trudeau of Canada originally promised to bring in 25,000 Syrian refugees by January 1st, 2016. However, Canada did not achieve this goal and the deadline was moved back to March 1st, 2016. Overall, from November 4th, 2015 to January 29th, 2017 there have been 40,081 Syrian refugees admitted into Canada. On the other hand, President Obama and the United States government set a goal to admit 10,000 Syrian refugees for fiscal year 2016. From October 1st, 2010 to August 31st, 2016 the United States accepted a total of 12,623 Syrian refugees. This data shows that there is a higher percentage of Syrian refugees living in Canada than in the United States. Therefore, this comparative study aims to explain the key factors that have caused Canada to approach the Syrian refugee crisis in a more hospitable way than the United States. It will take into account the impact of the public opinion and the history of immigration and security on the admittance of Syrian refugees. Ultimately, this will provide an explanation of the facilitators and barriers for countries to intervene and to what extent when there is a humanitarian threat.

Research Methods

Samuel Mason

Mentor:

Dr. Marty Jordan,
Political Science

In light of the recent immigration executive orders that have been put in place by Donald Trump many questions have arrived about immigrants and the type of production that they may provide to the U.S. economy. This presents an interesting question that should be answered: does the percentage of foreign born immigrants within a Michigan county increase economic growth/activity overall? Many people seem to hold the belief that they do not provide a significant amount of production and in fact they seem to have a negative effect upon the economic activity and growth of the United States. Hopefully, through this study, the revelation that the percentage of foreign born immigrants will positively correlate with an increase in economic growth overall.

The Correlation between Democracy and War

Ian McNamara

Mentor:

Dr. Marty Jordan,
Political Science

There has been an undisputed rise of democracy in various countries throughout the world in recent history. This paper will explore the correlation between the increase in a country's level of democracy and its likelihood to get involved in a war, especially inter-state or civil wars.

Influence of Faith Based Prison Reform on Recidivism

Maxwell Nipke

Mentor:

Dr. Jeffrey Polet,
Political Science

The goal of the research presented is to measure the effectiveness of faith based prison reform programs in the U.S. That is, reform programs that use religion, primarily Christianity, which influence changed behavior. The effectiveness of faith based prison reform will be measured by comparing and contrasting it with other prison reform programs both within in the prison, and those utilized during the re-entry process. It will be measured against programs in the U.S. by examining the differences of said behavior of inmates in prison that do have these programs and prisons that do not. Recidivism rates and in prison behavior will be use as primarily measures among several others. The U.S. spends roughly \$22,000 per year to keep prisoners incarcerated. Multiply this by the two million prisoners the U.S. houses, the U.S. spends a large amount of money housing prisoners. By reducing recidivism the U.S. can begin reducing the prison population, and, by extension, start directing money previously used for prison towards other government funded programs.

America's Support for LGBT+ Marriage

Secret Permenter

Mentor:

Dr. Marty Jordan,
Political Science

In this project relying on a national public opinion survey, I will examine Americans' support for LGBT+ marriage, assessing the key factors that explain variation in support.

Sex Trafficking in the United States and Russia

Lauren Prince

Mentor:

Dr. Jeffrey Polet,
Political Science

Human trafficking in the form of sex trafficking is an issue that has continued to grow around the world. In the global world today, the US Department of State ratings shows that Russia is a tier three country indicating a high percentage of trafficking and the United States is a tier one country indicating a low percentage of trafficking. However, both countries still contribute and supply to a larger market for other countries to trade with. The purpose of this paper is to understand which factors are present in tier one and tier three countries that could be contributing to the growth of trafficking in tier one countries. In studying the sex trafficking industry in both countries, this paper will underline the contributing factors such as; poverty rates, globalization, and government legal systems. This paper begins by outlining the problem: sex trafficking, and then goes on to outlining contributing factors in both countries. Following, this paper examines whether or not laws are in place in each country that would help lower the percentage of trafficking within their country. This paper concludes by discussing possible solutions.

Reading before Voting in the House: Why “Read the Bill” Acts Fail

Mallory Reader

Mentor:

Dr. Jeffrey Polet,
Political Science

Representation is a cornerstone of American democracy, and the House of Representatives embodies this best by voting bills into law on behalf of their constituents. Members of Congress have previously introduced legislation that would require Members to read the full text of a bill prior to voting in order to increase accountability and representation of the voters, but these bills have never progressed in either chamber nor drawn much public attention. This paper asks whether Members of the House need to read bills in their entirety by examining public opinion, voting behavior, and incumbency rates. A comparative case study between Representative Bill Huizenga (MI-02) and Representative Justin Amash (MI-03) will serve to supplement the study as the latter fully read all bills before voting in his first term. The purpose of this paper is to determine if it is necessary for Members to read bills before voting on them in the House of Representatives in order to best represent the residents of their districts. This study concludes by raising questions on the ethics of governmental representation of voters.

To What Degree Does Expanding Political Freedoms Affect an Individual’s Satisfaction?

Madeline Shupe

Mentor:

Dr. Marty Jordan,
Political Science

This research will analyze whether governmental expansion or restriction of political freedoms affect an individual’s personal satisfaction and outlook. I rely on the 2012 Voice of the People End of Year Survey, containing approximately 60,000 responses from citizens of 56 different countries, asking a variety of questions related to individual values and degree of personal contentment.

State Partisanship and Voter Turnout

McKenna Stam

Mentor:

Dr. Marty Jordan,
Political Science

This research will examine the extent that one-party control of U.S. state institutions has on voter turnout within the state. Relying on a “U.S. States’ Politics” dataset including information on the degree of one-party control of legislatures and governors’ offices, I assess their effect on aggregate voter turnout.

Celebrity Influence on American National Elections

Luke Stehney

Mentor:

Dr. Marty Jordan,
Political Science

Celebrities have played a public role in politics for a long time, often advocating their views on national platforms that influence people who see them. Celebrity endorsements continue to thrive onwards into 2017 with the question remaining over their actual influence on the American public. This research assesses the role that celebrity influence played in the 2016 presidential primaries.

The Myths and Realities of the Independence of the Federal Reserve System

Andrew Villanueva

Mentor:

Dr. Jeffrey Polet,
Political Science

The independence of the Federal Reserve System has been a topic of debate since 1951. The debate being center upon whether independence is true in nature or is influenced by short-term political agendas has been called into the legitimacy of the Federal Reserve’s use of monetary policy. Does the Federal Reserve use their monetary policy in a manner that is strictly natural and mathematical to fit the economic needs, or is it impacted by outside political gain? Through examination of what the nature the Federal Reserve is built on, along with past and current monetary actions, will allow for the myths and realities of the Federal Reserve System’s independence to be transparent.

What Effect Does Getting One's Information on an Election from Social Media Have on One's Political Knowledge?

Taylor White

Mentor:

Dr. Marty Jordan,
Political Science

With social media's increasing popularity in the everyday lives of Americans, and the popularity of elections in American society, it is often wondered if there is a connection between social media usage and political knowledge. Relying on a national public opinion survey, this research will examine the degree that getting one's electoral information from social media affects their level of political knowledge.

Democracy and Public Satisfaction

Miguel Williams

Mentor:

Dr. Marty Jordan,
Political Science

This research explores the link between expanding political freedoms and an individual's trust in and satisfaction with government.

Exploration of the Political Gender Gap in the U.S.

Ilena Yankoviak

Mentor:

Dr. Jeffrey Polet,
Political Science

While the majority of women voted Democrat in the 2016 election, why did 53% of white women vote Republican? The intention of this research is to examine the disproportionate difference between men and women in American Politics at the federal level. This is referred to as the gender gap. By understanding this we can determine how women vote and specifically how it affects their party identification. This is conducted through the exploration of historic literature. In the article *Behind Trump's Victory*, author Alec Tyson reveals the deep divisions in campaigns emphasizing the impact gender possesses. This paper analyzes the vast variables that give dimension to the research, and attempt to formulate an answer for the causation of the gender gap in American Politics.

Flourishing and the Unity of Virtues: Psychology Listens to Philosophy

Natasha Jaina Bernal
Juliette Collins
Rebekah Loker
Robert Henry
Kerri Knoll
Erin Freiburger

Mentors:

Dr. Lindsey Root Luna,
Psychology

Dr. Heidi Giannini,
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Psychology

This research was supported by the Nyenhuis Convergent Scholars Grant at Hope College.

According to classical virtue theory, as articulated by Aristotle and subsequently Thomas Aquinas, virtue is necessary for eudaimonia (i.e., human flourishing; Fowers, 2012). Positive psychologists have defined virtues as character strengths (Peterson & Seligman, 2004) and primarily studied them in isolation (e.g., the correlation between gratitude and well-being; Emmons & McCullough, 2003). In contrast with psychologists, philosophers have long examined virtues more holistically (e.g., Aristotle, 1999). In this view, all of the individual virtues coalesce as practical wisdom, which enables people to engage in virtuous responses in various contexts (Fowers, 2012). In light of this philosophical conceptualization, we plan to examine the interrelationships among virtues, evaluating a higher-order latent factor structure and its association with flourishing.

Existing psychological measures of virtues of interest were reviewed and revised to more accurately track Aristotelian and Thomistic perspectives. Our virtues of interest were the cardinal virtues (i.e., temperance, courage, justice, practical wisdom) and other virtues relevant within positive psychology and a Thomistic perspective (e.g., forgivingness, gratitude). Data were collected using an online Qualtrics questionnaire ($N = 170$). We will then evaluate a higher order structure, using structural equation modeling (Mplus software).

Preliminary correlation analyses among the individual Thomistic virtues (i.e., faith/spirituality, forgivingness, gratitude, hope, humility, patience) and flourishing revealed statistically significant relationships, $r_s = .24 - .52$, $p_s < .017$. Among the cardinal virtues, flourishing was correlated with justice ($r = .41$, $p < .001$), wisdom ($r = .35$, $p < .001$), and temperate attitudes toward food ($r = .22$, $p = .029$) and sex ($r = .30$, $p = .002$). We anticipate that a higher-order latent factor will correlate more strongly with flourishing. However, this study is largely exploratory given its interdisciplinary nature. Examining the utility of a higher-order latent virtue factor has the potential to shape the way we view and study the relationship between virtues and flourishing.

Predictive Validity of Mate Standards

Juliette Collins
Natasha Jaina Bernal

Mentor:

Dr. Carrie Bredow,
Psychology

Research is scarce regarding the circumstances under which implicit and explicit mate preferences predict people's partnering behaviors. Whereas explicit preferences may operate in more deliberate contexts (Eastwick, Eagly, Finkel, & Johnson, 2011; McNulty & Olson, 2015), the details of implicit preferences' situational functioning remain unclear, particularly in ongoing relationships, even though they may be important in early face-to-face interactions. The present study examines implicit and explicit mate preferences and their effect on present and future relational outcomes.

Using Amazon Mechanical Turk (MTurk) as our recruiting platform, unmarried individuals ($n=197$) completed an online series of three SC-IATs (Karpinski & Steinman, 2006), representing three major trait dimensions: physical attractiveness/vitality, warmth/trustworthiness, and status/resources. Participants also completed a questionnaire assessing their explicit mate standards, partner's characteristics, and relationship evaluations. Participants were contacted 3 months later and invited to complete a questionnaire similar to that used at T1.

Results revealed a weak positive correlation between implicit and explicit preferences for warmth/trustworthiness only at T1 ($r=.18, p<.05$) and no significant correlations were found for attractiveness/vitality and status/resources at either time point. Regression analyses showed predictive validity only for the warmth/trustworthiness dimension. Specifically, greater correspondence between people's *implicit* preferences and their partner's traits predicted greater relationship satisfaction at T1 ($p<.05$). Furthermore, greater correspondence between people's *explicit* preferences and their partner's traits predicted greater relationship satisfaction at T2, and this *explicit* preference-partner match was moderated by mate availability, such that preference-partner correspondence was more predictive for individuals with low perceived mate availability ($p<.05$). Perceived mate availability also moderated preference-partner match for status/resources: *implicit* preference-partner match was a better predictor of T1 relationship satisfaction among individuals with low than high mate availability ($p<.05$). For attractiveness/vitality dimension, perceived mate availability did not moderate preference-partner match.

The Role of Priming Disaster Images on Meaning, Religion, and God Associations

Kirstin Diepholz
Rachel Hibbard
Megan Edwards

Mentor:

Dr. Daryl R. Van Tongeren,
Psychology

*This work is supported
by The John Templeton
Foundation.*

How do people psychologically recover from disasters and restore a sense of meaning in their life? Disasters can potentially threaten physical and psychological well-being. Previous research suggests that when faced with a disaster, people are driven to restore a sense of meaning in their lives (Haynes et al., in press). In this study, we aim to discover how priming disasters affects participants' reported meaning in life and their concept of God (assessed both explicitly and implicitly). We hypothesize that (religious) participants faced with a disaster prime will reaffirm their meaning and religious values compared to those in the control group.

Participants were undergraduate introductory psychology students at a private Midwestern liberal arts college. First, all participants filled out individual difference measures about their personality and religious beliefs. Participants were randomly assigned to one of four conditions: (1) watching a video of a person driving through a major forest fire (natural disaster prime), (2) watching a video of the commercial airliners crashing into the Twin Towers on 9/11 (terrorist disaster prime), (3) watching a video of the BP oil spill and oil rig fire (technical disaster prime), or (4) watching a video of a nature scene with waterfalls (neutral prime). All participants were asked to imagine themselves in the situations depicted in the videos.

After the videos were shown, all sets of participants completed assessments on their implicit and explicit God associations and filled out a questionnaire about their reported meaning in life. Participants were then debriefed.

We are in the process of collecting data ($N \sim 80$; Target $N = 100$), but we expect to find the data will support our hypothesis that meaning in life will be reaffirmed when a person is faced with a disaster scenario and that God associations will also be reaffirmed for religious participants. To analyze the data, we will run an ANOVA test comparing participant's responses in all four conditions.

This research will provide experimental evidence for the link between disasters, religion, and reported meaning in life. In general, this research may provide insight into psychological disaster relief and coping mechanisms that people use to recover from trauma. As the title of the research suggests, we are interested in how people flourish within their given circumstances.



The Role of Virtuous Acts on Meaning in Life

Megan Edwards
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*This work is supported
by The John Templeton
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Research has focused on how creating and maintaining a sense of meaning in life is humankind's primary motivation (Heine, Proulx, & Vohs, 2006). These desires for meaning are assumed to reduce the existential anxiety that is derived from one's awareness of their own mortality (Greenberg, Koole, & Pyszczynski, 2004; Pyszczynski, Greenberg, Koole, & Solomon, 2010). Research suggests that mortality salience can elicit greater prosocial behaviors (Jonas, Schimel, Greenberg, & Pyszczynski, 2002). Similarly, other research has found that prosocial or virtuous behavior is associated with meaning in life (Van Tongeren et al., 2016). The purpose of this research is to examine the degree to which a virtue intervention may provide a sense of well-being, religiosity and meaning in life.

In this two-week longitudinal virtue intervention (instructing participants to commit to acting virtuously for the next two weeks), undergraduate participants completed measures of meaning in life, well-being, and religiosity. Participants were then randomly assigned to one of two conditions: (1) participants were asked to commit to acting as virtuously as possible in all of their daily interactions for the following two weeks (virtuous condition; VC), or (2) participants were asked to commit to being fully present in all of their daily interactions (present condition; PC). Data were collected at baseline (T1), one week later (T2= 7 days after T1), and two weeks later (T3= 14 days after T1). Accordingly, participants completed these follow up surveys by indicating how virtuously (VC) or fully present (PC) they acted during the week. Participants then completed the same prior measures on meaning in life, well-being, and religiosity.

We predict that those assigned to the virtue intervention—being instructed to act more virtuously—will report greater meaning in life after T3 than at T1 and in comparison to those who acted fully present. Data collection is ongoing (N~80; target N=100) and we plan to use multilevel modeling in our analysis of the data. This research will help us better understand the ways in which virtuous behaviors affect well-being, as well as identify potential experimental and clinical interventions to increase virtue, and, in turn, enhance meaning in life.

Self-Regulation as an Underpinning Mechanism of Virtue

Kerri Knoll
Erin Freiburger
Rebekah Loker
Natasha Jaina Bernal

Mentor:

Dr. Lindsey Root Luna,
Psychology

With the advent of positive psychology, virtues have received significant attention by psychological researchers. Previous studies have focused on individual virtue constructs (e.g., forgiveness, gratitude, patience; Dwiwardani et. al, 2014; Schnitker, & Emmons, 2007), to the exclusion of considering virtue holistically. Several of these studies have found connections between the individual virtue constructs and self-regulation (Doerr & Baumeister, 2010) or self-control (e.g., Baumeister & Exline, 1999). However, self-regulation and self-control are often used interchangeably in the literature when a strong argument can be made to be more precise with their definitions. Self-control represents an effortful decision over one's behaviors whereas self-regulation can include both effortful control and automatic processes (McCullough & Willoughby, 2009). This distinction is particularly important in light of classical virtue theory (e.g., Aristotle, 1999). Aristotle posited several character types, including the continent person (who chooses the virtuous action, despite conflicting desires) and the virtuous person (who chooses the virtuous action in concert with harmonious desires). Undergraduate students (anticipated $N = 150$) will complete several questionnaires in order to test our hypothesis that virtue and self-regulation, more than self-control, are correlated. Individual virtue constructs, both cardinal virtues (i.e., temperance, courage, justice, practical wisdom) and more modern virtues (e.g., forgivingness, gratitude, hope) will be measured, along with scales reflecting effortful self-control, automatic self-regulation, flourishing, and social desirability. We anticipate that participants high in self-reported virtues will also be high in self-control or self-regulation. In addition, we expect only virtuous participants will be high in both self-reported virtue and self-regulation, and these participants will endorse greater flourishing. In contrast, we hypothesize that continent participants (those high in self-control but not self-regulation) will endorse greater social desirability. We hope that these findings will spur on further experimental work examining the potential relationship between self-regulation and virtue.



The Superior Colliculus (SC) is Necessary for the Normal Display of Diurnal Behavior in Nile Grass Rats

Alyssa Goodwin
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Mentor:

Dr. Andrew Gall,
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This research was supported by the Howard Hughes Medical Institute through the Undergraduate Science Education Program. This research was also supported by a Nyenhuis grant from Hope College, and by Start Up Funds from the Division of Social Sciences at Hope College.

The circadian system regulates daily rhythms of physiology and behavior and thus, it affects many aspects of daily life. Although there has been tremendous progress elucidating the mechanisms responsible for the workings of the circadian system in nocturnal species, little is known about the mechanisms that support a diurnal profile of activity in species like our own. Recent data has shown that retinorecipient brain areas such as the intergeniculate leaflet (IGL) and olivary pretectal nucleus (OPT) are critical for the display of normal patterns of daily activity in diurnal grass rats (*Arvicanthis niloticus*) (Gall et al., 2013, 2014). Specifically, grass rats with IGL and OPT lesions behave in ways similar to nocturnal animals. Importantly, both the IGL and OPT project to one another in nocturnal species, and there is evidence that these two brain regions also project to the superior colliculus (SC). The superior colliculus (SC) receives direct retinal input, is involved in the triggering of REM sleep in nocturnal rats (Miller et al., 1998), and is disproportionately large in the diurnal grass rat (Gaillard et al., 2013). The objective of the current study was to use diurnal grass rats to test the hypothesis that the SC is critical for the expression of diurnal behavior and physiology. We performed bilateral electrolytic lesions of the SC to examine the diurnal behavioral patterns and acute responses to light in these animals. The majority of grass rats with SC lesions expressed significantly reduced activity in the presence of light. Exposing the grass rats to constant darkness reinstated activity levels during the subjective day, suggesting that light masks their ability to display a diurnal activity profile in 12:12 LD. Altogether, our data suggest that the SC is critical for maintaining diurnal behavior. This research has implications for understanding Alzheimer's Disease (AD) and Parkinson's Disease (PD), neurological disorders in which diurnal behavior is severely disrupted.

Does Grit Crack
under Pressure?
Trait Grit, Primed
Self-Awareness,
and the Influence
on Physiology

Abstract not available online.

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Mentor:

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Psychology

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by a summer research grant
from Psi Chi and the Council
of Undergraduate Research.*

Genetics, Gender
and Gratitude

Abstract not available online.

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Elizabeth Perkins
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The Effects of Priming Heroes on Helping Intentions and Meaning in Life

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*With support from The John
Templeton Foundation*

Two experiments studied the effects of priming fictional superheroes (Experiment 1) and personal heroes (Experiment 2). We hypothesized that when primed with heroes, people would be more likely to help, and would report more meaning in life. In Experiment 1 participants from MTurk (N=241) were randomly assigned to a hero condition, in which they were implicitly primed with images of popular fictional superheroes, such as Superman or Spider Man, or a neutral condition, which did not include these heroic logos. After this priming, participants were given hypothetical situations in which they were to rate how likely they would be to help someone, and the Meaning in Life Questionnaire. Experiment 2 consisted of explicitly priming of a personal hero. Participants (N=257) were randomly assigned to instructed to write a paragraph describing their personal hero or to a neutral condition. They were then given the same measures as in Experiment 1, in which they reported their likelihood to exhibit helping intentions and their sense of meaning in life.

For Experiment 1, results showed that when implicitly primed with a fictional superhero, participants reported higher helping intentions, which was associated with greater meaning in life. However, in Experiment 2, when asked to write about a personal hero, participants reported lower meaning in life in comparison to control conditions, which was mediated by lower helping intentions. Although the results from Experiment 1 support our hypothesis, whereas Experiment 2 did not, the difference in responses is intriguing. There is an oppositional effect that occurred when implicitly primed with fictional heroes relative to explicitly reflecting on personal heroes. It is likely that the content (abstract versus personal hero) and method (implicit versus explicit) of the hero priming induction matters greatly. The complex relationship between these variables and method in the current experiments are discussed.



Associations of Religious, Spiritual, and Health Behaviors Examined through Daily Diary Methods

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Mentors:

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Psychology

Religiousness and spirituality are associated beneficially with health. Mechanisms of these associations have not been established, but health behaviors may explain associations. We are interested in whether there is an association between religious and spiritual (R/S) behaviors and health behaviors in undergraduates. Daily exercise and diet were assessed and associations with R/S traits and behaviors were tested. Increasingly, daily diary methods are employed in health research because they decrease retrospective reporting and increase validity. However, these methods have not been used in research on R/S. We are conducting a daily diary study via online survey. Participants were recruited from Hope College. During an initial lab visit, participants took a survey on baseline and trait R/S and overall health and were trained on how to complete daily diary surveys which they did for the following seven mornings. These surveys assessed participants' daily religious, spiritual, and health behaviors and experiences. We will analyze data using correlational analyses and regression to determine whether and how R/S traits and daily behaviors are associated with healthy daily exercise and diet behaviors. We expect that greater trait R/S will be associated with healthier daily exercise and diet. We also expect that engaging in more daily R/S behaviors will be associated with healthier daily exercise and diet. First, our study suggests that using daily diary methods to study R/S is feasible. Second, if trait R/S are associated with better health behaviors, that would suggest that health behaviors could be a mechanism of observed associations of R/S with health. Third, if R/S behaviors are associated with healthy diet and exercise, this may further explain associations of R/S with health. Last, these findings could help in understanding and promoting healthy diet and exercise on college campuses.

Religiosity Attenuated the Appearance Based Self-Worth and Body Esteem Relationship in Men

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Abstract not available online.

With support from The John Templeton Foundation

Childhood Physical Activity and Nature Experience as Predictors of Adult Perspectives on Nature

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Amanda Gibson

Mentor:

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Previous research has explored the benefits of connecting children with nature (Louv, 2005, Wells, 2006). A parallel discussion has emerged focusing on adults' experience of "nature deficit disorder" due to lack of connection to nature (Louv, 2011). Prior research suggests a relationship between childhood experiences and adult preferences. Some studies have specifically compared adults' nature exposure to their preference for being outdoors and physically active as children (Thompson et al., 2008, Henniger, 1994). Similarly, this study explores the relationship between retrospective childhood physical activity and nature experience and current adult perspectives on nature exposure. The study utilizes a self-report survey aimed at understanding college students' perspectives and experiences. We hypothesized that those who were encouraged to and spent more time in nature as children would be more likely to value and spend time in nature as adults. Preliminary correlational analyses revealed a significant relationship between parental encouragement of free-time outdoor play and enjoyment of outdoor activities as children. Additionally, participants indicated they would be less restrictive with their own children with respect to activities that they, themselves, enjoyed in childhood. Those who considered nature an important part of learning enjoyed more outdoor and physically active activities as children. There was also a correlation between weekly hours spent outside as a child and hours per week spend outside as an adult. These preliminary findings underscore the importance of the childhood-nature connection and its implications for mitigating nature deficit disorder in adulthood. Further analyses explore which childhood nature experiences serve as predictors for current engagement with nature, physical activity level, and perceptions of nature's importance and benefit for learning.

Childhood Technology Use: A Predictor of Adult Perspectives on Technology in Education

Amanda Gibson
Kara Lurvey

Mentor:

Dr. Sonja Trent-Brown,
Psychology

Technology is ubiquitous in today's society, particularly since the advent of smartphones, and has been increasingly becoming a vital component of education (Rosen, 2013). This study seeks to understand how childhood and adolescent technology usage informs college students' perspectives of the importance of technology for education. A self-report Qualtrics survey explored college students' experiences and perceptions of technology use. Survey questions pertain to the age of initial implementation of various technologies and frequency of classroom technology use. Furthermore, this survey assesses participants' perceptions of the importance of technology for learning and the benefit of increasing technology use in the classroom. Preliminary correlational analyses have been conducted to assess the relationship between previous usage and current perceptions. Further analyses determine which past technology experiences serve as predictors for current perceptions of its importance and benefit for learning. A higher frequency of technology use in elementary and middle school classrooms was associated with a higher perceived importance of electronics for learning, and a higher perceived benefit for increasing classroom technology use. In addition, students who received their first cellphone/smartphone at a later age viewed electronics as less important for learning. Similarly, students who first engaged with both one-on-one technology and various types of screen-based play at younger ages were more likely to rate increasing technology use as beneficial for preschool through elementary school classrooms. Childhood enjoyment of electronics was also positively associated with a perceived benefit of increasing technology in middle school through college. These students will be future parents and teachers, and their perspectives can help shape how future generations interact with technology. As technology continues to develop, researchers must investigate societal perceptions and impact as well as the implications of technology for desired educational outcomes.

Implications of a Nature-Based Science Enrichment Program for Biosocial and Psychosocial Developmental Outcomes

Kara Lurvey
Trechaun Gonzalez
Emily Forster
Amanda Gibson

Mentor:

Dr. Sonja Trent-Brown,
Psychology

A nature-based, outdoor science enrichment program was implemented in a variety of local preschools with the aim of improving the development of the whole child and of encouraging increased engagement with the outdoors. This research evaluated biosocial and psychosocial developmental outcomes of the enrichment program. In particular, we considered social-emotional, gross motor, and fine motor skills. We examined the relationships between these skills and activity preference, BMI, and demographic variables. The activity preference measures assessed indoor versus outdoor and active versus sedentary activity preferences. In addition, this research investigated the effectiveness of varying frequencies of nature enrichment, ranging from daily to once monthly, for inciting positive changes in the health and development of the preschool students. This study provides implications for the design of preschool curricula, particularly for considering the benefits of both nature-based preschools and the integration of nature-programming elements within traditional preschools.

Implications of a Nature-Based Science Enrichment Program for Early Literacy and Cognitive Development Outcomes

Kara Lurvey
Trechaun Gonzalez
Emily Forster
Amanda Gibson

Mentor:

Dr. Sonja Trent-Brown,
Psychology

An outdoor, nature-based, science enrichment program was implemented in a nature preschool and traditional preschools to connect children with nature and to determine the impact of the nature curriculum on the activity preference, health indicators, and cognitive development of preschoolers. With an emphasis on whole child development, this evaluation explored early literacy and cognitive developmental outcomes, specifically, communication, problem solving, language, and mathematics indicators. We examined the relationships between these skills and activity preference, BMI, and demographic variables. Multiple activity preference measures assessed both active and sedentary preferences as well as preferences for indoor versus outdoor activities in individual and social settings. This study also investigated the impact of the frequency of nature-based learning on the development of preschoolers as well as patterns across demographic variables and impact of the outdoor learning environment. This work has implications for preschool curriculum design in nature-based preschools and in traditional preschools.

Associations of Supernatural Beliefs and Depressive Symptoms in Three Nationally Representative Samples

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Rudy Kelly
Mark Fisk

Mentor:

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Psychology

People who engage in religious practices are generally healthier than those who do not. Despite the growing research on these associations, few studies have examined how afterlife and other “supernatural” beliefs are associated with mental health. One study found that beliefs in the afterlife were associated with fewer psychological symptoms (Flannelly, Koenig, Ellison, Galek, & Krause, 2006). Follow up studies have suggested that this association may depend on the positive or negative nature of such afterlife beliefs (e.g., Flannelly, Ellison, Galek, & Koenig, 2008). Similarly, images of God as angry have been associated with worse mental health (e.g., Silton, Flannelly, Galek, & Ellison, 2014), further suggesting that negative supernatural beliefs would be associated with more psychological symptoms. However, these studies have not examined supernatural beliefs such as the belief in angels or demons.

The present study analyzes the link between mental health, specifically depressive symptoms, and a variety of religious afterlife and supernatural beliefs. For the present study, we identified three nationally representative datasets from the Association of Religion Data Archives with items which assessed depressive symptoms and afterlife and supernatural religious beliefs: the Portraits of American Life Study (PALS), the Baylor Religion Survey, and the National Study of Youth and Religion (NSYR). PALS is a panel study of over 2,500 adults. The Baylor Religion Survey is a multi-year study of over 1,500 adults. The NSYR is a multi-year telephone survey of over 3,000 teenagers. We are analyzing associations of supernatural and afterlife beliefs with depressive symptoms in each dataset using basic correlational analyses and regression. Initial results suggest an association of supernatural beliefs with more depressive symptoms. Complete descriptions of beliefs and depressive symptoms in each sample will be presented along with predictive findings. The implications of our findings for the field and for health will be discussed.

Acoustic Variation among African American and European American Children: Age, Gender, and Ethnicity

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Nicole Marsh

Julia Licata

Brooke Ledsworth

Marissa Lozser

Mentor:

Dr. Sonja Trent-Brown,
Psychology

Previous research shows that vowels are acoustically specified based on formant frequencies (Peterson & Barney, 1952). Their study was replicated and extended to include temporal and spectral measurements (Hillenbrand et al., 1995). While both studies included children, Peterson and Barney did not indicate age or gender, Hillenbrand et al. did not distinguish across gender, and neither study included data with respect to ethnicity. Therefore, more data is needed that provides the acoustic targets for children that take age, gender, and ethnicity into consideration.

This study explores variations across age, gender, and ethnicity. There is a gradual lowering of the fundamental frequency of the voice beginning with the onset of puberty, which could begin as early as age 10 (Berger, 2008). This influences the phonological space, which could result in differences across gender, especially for the 11 to 12 year olds. Children recorded lists containing neutral consonantal context /h-vowel-d/ words and sentences.

We hypothesize that fundamental and formant frequencies will be higher for 8 to 9 year olds than for 10 to 12 year olds and higher for girls (by age 10). With respect to ethnicity, we anticipate no significant differences in frequency measures between European-American and African-American children. We will present MANOVA results for age, gender, and ethnicity with temporal and spectral parameters. Additionally, we will report correlational analysis of height and weight with the acoustic measures.

This study will contribute to our knowledge of developmental trajectories for specific acoustic parameters. As gender and ethnicity are vital cues for adult speakers, it is important to investigate how salient the acoustic parameters are for child speakers and at what ages the child parameters begin to approximate adult measures. Results will have implications for audiologists, speech language pathologists, developmental and speech scientists, and others in the field of communication sciences and disorders.

The Effects of Disasters on View of and Relationship with God

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*This research was supported
by the John Templeton
Foundation.*

Disasters can be a considerable threat to one's sense of meaning. We examined the effects of priming disaster related stimuli on participants' view of and relationship with God. Participants were randomly assigned to one of four conditions: (a) implicit disaster threat, (b) explicit disaster threat, (c) implicit neutral prime, or (d) explicit neutral prime. Next, participants completed measures of meaning in life, as well as scales assessing their views of God (e.g., authoritarian, benevolent) and their relationship to God, including an implicit assessment of their relationship with God. We hypothesize that (religious) participants faced with a disaster prime will reaffirm their meaning and religious values compared to those in the control group. We also sought to explore how the disaster prime would affect how people related to God.

We are in the process of collecting data ($N \sim 50$; Target $N = 100$), but we expect to find the data will support our hypothesis that meaning in life will be reaffirmed when a person is faced with a disaster scenario and that God associations will also be reaffirmed for religious participants. We will also examine whether the primes affected how relate with God. To analyze the data, we will run an ANOVA test comparing participant's responses in all four conditions.

This research has the potential to inform how religious and spiritual values may play a role in overcoming larger meaning threats, such as disasters.





Perceptual Differentiation of African American and European American Children Based on Gender and Ethnicity of Listeners

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Thomas and Reaser (2004) demonstrated that adult speakers can be perceptually differentiated by listeners with respect to gender and ethnicity. They presented data from various studies with respect to adult speakers, but no data for child speakers. It follows that there are cues in the acoustic signal that support making distinctions amongst adult speakers. Following the onset of puberty, these acoustic parameters begin to emerge, enabling listeners to reliably identify speaker characteristics in adulthood (Berger, 2008). The question remains, at what point across the pubertal transition does perceptual accuracy meet the level for adult speakers? The goal of our research is to examine how the gender and ethnicity of the listener affects the accuracy with which they are able to identify these same aspects of a child speaker.

Undergraduate students completed a language background questionnaire and then listened to audio recordings of European American and African American children producing /h-vowel-d/ words and sentences. The participants listened to four blocks of recordings: forward words, reverse words, forward sentences, and reverse sentences, containing items spoken by children of each ethnicity, age, and gender. The listeners identified which ethnicity and gender they believed the speaker to be, as well as how confident they were of their choice.

We expect that minority (African American, Hispanic, Native American, Pacific Islander, and Asian American) and female participants will have greater accuracy for all speakers. We also anticipate that accuracy of identification will improve as the age of the speaker increases due to the changing of the voice as a result of puberty.

The study will provide greater knowledge of how the age of a child speaker impacts the ability of the listener to identify the speaker's gender and ethnicity. The implications can be informative for individuals who work with children and in speech-related professions.

Sleep in College Students: How is Sleep Related to Daily Health and Spiritual Behaviors, and How Does Sleep Education Affect Sleep Quality and Quantity?

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College students are particularly susceptible to sleep issues because college creates an environment where the vulnerabilities to poor sleep are high, which can interfere with everyday functioning. Along with sleep, religiousness and spirituality also have been shown to have a positive impact on health. Few studies have examined the effect of educational interventions on sleep patterns in college students. The present study aims to explore the relationships between sleep, health, light, and spirituality/religiousness in college students. Additionally, we will implement an educational intervention to determine its effect on sleep quality and quantity. Participants will complete a pre-survey that collects information about demographics, sleep quality and quantity, religious behaviors, certain dimensions of physical health such as diet and exercise, and their state of well-being and mood. Some participants will then be asked to watch a short sleep education video, while others will watch an unrelated educational video. Following the pre-survey, a subset of participants will be given a FitBit to collect data on daily sleep and wake cycles. In addition, all participants will be asked to complete a daily survey each morning for a week. At the end of the week, an exit survey will be completed along with the final daily diary. Data collection will be completed by April. We expect to find that daily religious and spiritual behaviors are associated with healthy behaviors, including sleep, in college students. In addition, we expect that an educational intervention will influence sleep quality and quantity. Finally, we predict a negative relationship between light and sleep. This project seeks to increase awareness of the importance of sleep, especially as it pertains to health in college students and how religiosity and spirituality might play a role in that relationship.

Genotyping Methods: OXTR rs53576

This project was an interdisciplinary endeavor between the Department of Biology and the Department of Psychology. See page 37 in the biology section of this book for full abstract.

Promoting Best Practices in the Tenure Process

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The current study is an evaluation of pre-tenured and tenured faculty and their practical and emotional experiences to the tenure process. Previous empirical evidence suggests that post tenured professors are less happy with tenure than they thought they would be (Wilson, 2012). The topic of tenure and the academic's experience around tenure abounds in popular literature, however the gaps are plentiful in regards to peer reviewed, empirical research. While the literature separately discusses various aspects of acculturation, flourishing, gender, race, culture shock, emotional processes, and the abilities for professors to affectively forecast their emotions, the current study jointly integrates all of these topics. An online snowball survey sample over the course of two and a half months allowed for geographically and institutionally diverse subjects. Preliminary results from this study suggest that higher levels of mainstream acculturation, alignment with the institution's values, and guidance leads to higher levels of general positive emotion. Second, higher levels of heritage acculturation lead to higher levels of general positive emotion. Third, mainstream and heritage acculturation are positively correlated with flourishing scores. Additionally, there was also a significant difference between public and private institution faculty feelings toward the tenure process. Pre-tenured faculty members, who show higher levels of anxiety and depression, also display inaccurate affective forecasting of their emotions around the tenure process. The methodology and results will be presented as well as suggestions for institutional opportunities for improvement and future research.

Concepts of Trust among Residency Students and How It Relates to Reciprocity and the Public Goods Dilemma

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Reciprocity and trust are necessary within any group. The benefit of this reciprocity and trust, however, is felt more by the group than the individual who trusts or reciprocates. This public goods dilemma can be problematic for residency programs because these programs need high levels of both trust and reciprocity to function smoothly. I use James S. Coleman's ideas on trust and free-riders to explain how reciprocity in a residency program depends on how connected residents are to one another and how this impacts their perceptions of trust in one another. Using longitudinal data from a pediatric residency program, I look at how residents could have differing levels of trust based on connections with others in the residency program. Students who socialize with other residents generate more social capital, leading to higher levels of trust and reciprocity. On the other hand, socializing with non-residents fosters lower levels of social capital, hindering reciprocity and trust.

Mental Health within Residency

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Medical school brings with it much stress, as the rigors of medical education are tiring, extensive, and consuming. This often increases during residency and can take a serious toll on residents' mental well-being, both in the short and long term, affecting their functioning both within and outside of the program. Residency can adversely affect residents' level of anxiety, depression, stress and more, deteriorating job performance and overall mental stability. This study focuses on pediatric residents and their mental health and overall mental well-being. We used longitudinal data from a larger children's hospital. Building on theories prioritizing the importance of repeated interactions within specific groups, and how these interactions influence a sense of familiarity and commonality, leading to enhanced mental health. Findings indicate that the more friends reported within the residency the more respondents report trust in co-residents, affective regard for co-residents, greater social unity, and higher commitment to co-residents. Second, the more socially integrated residents were within the program, the lower their reported overall stress, fewer reported days experiencing bad mental health, and better overall self-rated health. Finally, and perhaps most importantly, as residents report more friends within the residency program they also report feeling "alone" less often.

The "Good" Physician: Role Perceptions, Beliefs, and Patient Interactions

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collaborative research.*

When sick, patients understand their conditions in the terms of their everyday experiences. How normal rhythms are impacted, interrupted or disturbed. Religion, for many, plays an integral role in making sense of experiences, but processes of healing often do not include these meaning making structures such as religious beliefs. This potentially hinders patients' healing processes or at least their experiences with healthcare. Over the years, research has shown that patients would like their physicians to ask about or at least be aware of their religious/spiritual beliefs (Ehman et al. 1999). Physicians, however, tend to deemphasize religion in interactions with patients even while they tend to agree on the potential importance of religion (Armbruster, Chibnall, and Legett 2003). This project focused on the relationship between a physician's personal beliefs and values and their professional beliefs and values in an attempt to understand how or when there is an overlap, and whether this overlap influences perceptions regarding what they should be doing as a physician. That is, what do they think they ought to be doing, and is this patterned by their personal beliefs? Semistructured interviews were conducted with southwest Michigan physicians to understand these questions. We found that most physicians could articulate how their own beliefs or values influenced the attitudinal/relational dimension of medical care, forming a foundation for these professional values. Moreover, respondents' personal beliefs and values also seemed to influence the stability of physician's identity as physician. In particular, they spoke of a more unified identity (little to no separate "personal" and "professional" persona), and having an emotional buffer with which to cope with the professions' pressures.

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