

2017-  
2018

# ABSTRACTS

The 17th Annual  
Celebration of Undergraduate Research  
and Creative Performance



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# CELEBRATION OF UNDERGRADUATE RESEARCH AND CREATIVE PERFORMANCE AURA AWARD

## Hope College Wins National Award for Undergraduate Research Accomplishments

The Council on Undergraduate Research awarded Hope with its 2017 campus-wide Award for Undergraduate Research Accomplishments (AURA). The award recognizes exceptional undergraduate research, scholarship, and creative activity programs.

Only nine colleges and universities national wide, three per year, have received the recognition since the award program began in 2015. Hope is the only institution in Michigan to have earned the award. Go Hope!

## ELITE COMPANY

Hope received a Campus-Wide Award for  
Undergraduate Research Accomplishments  
from the Council on Undergraduate Research



since the annual recognition program began in 2015



April 13, 2018

Dear Friends,

We are pleased to welcome students, guests, and community members to the 17th 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.

Involving students in faculty-mentored scholarship is a hallmark of Hope's academic program. 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.

This year's Celebration includes 247 presentations by 382 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. Hope students regularly receive national recognition for their research accomplishments with NSF Graduate Research Fellowships, Fulbright Scholarships, Goldwater Scholarships, and professional society awards.

Hope College is nationally recognized for the extent and quality of its undergraduate research program. The Council on Undergraduate Research presented Hope College with a 2017 campus-wide Award for Undergraduate Research Accomplishments (AURA) for Hope's exceptional undergraduate research, scholarship, and creative activity programs. Only nine colleges and universities nationwide have received this recognition, and Hope is the only institution in Michigan to have earned the award.

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](http://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

**Spontaneous  
Emotional Searching:  
A Contemporary  
Analysis of  
Humanistic Action**

**Carolyn Ellis**

Mentor:

Dr. Heidi Kraus,  
*Art and Art History*

*This research was supported  
by the Hope College Mellon  
Scholars Program.*

Artifacts from the life and career of West Michigan artist and writer, Harry Brorby, reveal his interest in expressing emotion through art which, this study suggests, led him to create an autonomous artistic identity. Brorby wanted to create new and unique works of art that were not simply based on antique methods and traditional art, but works that found their rooting in contemporary influence, self-expressionism and self-actualization. This examination takes the connection between the sister arts of painting and poetry as a springboard for investigating the spontaneous emotional searching present in Brorby's work and is evidenced in his *Yellow Series*. Writing and art have long shared a connection in their nature, content, and purpose, but differ in means and manner of expression. Painting, like poetry, fulfills its highest function in its representative imitation of human life, placing the power to express human emotion in the creator's hands to explore beyond the antique and provide purpose. A thorough investigation of Brorby's art and writings were juxtaposed with art critics and theorists from Aristotelian philosophy (including Dolce, Bellori, Poussin, and Lomazzo) as well as Resslerer W. Lee's seminal 1980 essay, *Ut Pictura Poesis: The Humanistic Theory of Painting*.

**Motion Design Reel**

**Jared Vite  
Sarah Sanders  
Emma Schipper  
Kelly Ocock**

Mentor:

Professor Sara  
Alsum-Wassenaar,  
*Art and Art History*

This reel is a collection of motion design projects from students in Design 2. Students worked to create motion expression with graphical elements to capture attention in digital space.

**How We Create**

**Raven Bouvier**

Mentor:

Professor Linda Graham,  
*Dance*

Creativity is something that defines the human race. Despite this, it seems we know very little about how creativity functions. Through research and interviews I have attempted to understand creativity's relationship with ritual in order to better understand how we are creative.

## What Women Want: Portrayals of Women in Medieval Literature

**Hannah Winegar**

Mentor:

Dr. Marla Lunderberg,  
*English*

The question “What do women want?” has perplexed many for centuries. In the Middle Ages, Chaucer’s *Wife of Bath* and Margery Kempe’s autobiography provide unique perspectives to this question. Chaucer’s *Wife of Bath* declares she wants freedom to marry multiple times and she tells a story that argues women want a form of sovereignty. However, this vivacious, attention-grabbing character who claims that women want sovereignty actually demonstrates a deep need for human connection. In contrast to Chaucer’s male vision of women’s desires, Margery Kempe, in her autobiography, gives a different read: Kempe seeks true relationships, but unlike the Wife of Bath, does so in the context of her relationship with Christ, rather than seeking relationship satisfaction from men. My research compares Chaucer’s *Wife of Bath* and Margery Kempe’s autobiography, looking at the ideas of how both gain attention, how both desire sovereignty over those around them, and how both desire relationship. My paper closes by examining how Aemilia Layner picks up these same questions in the early modern era.



## ARTS & HUMANITIES

### HISTORY

#### “We All Must Do Our Utmost:” Holland, Michigan in World War I

**Natalie Fulk**  
**Aine O’Connor**  
**Avery Lowe**

Mentors:

Dr. Jeanne Petit,  
*History*

Geoffrey Reynolds,  
*Joint Archives of Holland*

*This work was supported by the Third Reformed Church Faculty Development Fund, part of the Nyenhuis family of funds, the Hope College Department of History Pagenkopf History Research Fund, and the Joint Archives of Holland.*

“To save the world from such a fate, we all must do our utmost.” So wrote Hope College theology professor John Kuizenga in late 1917. He was writing to Hope soldiers “over there” on the importance of making the world, as President Woodrow Wilson had put it just months earlier, “safe for democracy.” The Great War had raged since July 1914, starting as an European conflict which spiraled outward to engulf what felt like the entire world. As men from Hope College and Holland enlisted, those on the homefront decided to “do their utmost” in the great cause for America. The “utmost” manifested itself in different ways for Hollanders and Hope students, but whether through fighting or farming, fundraising or flying the flag, all participated in the war effort. The war ended in November 1918, and a stunned silence fell over the world as humanity grappled with what had transpired. Whole countries had burned, but even small communities like Holland—seemingly so far from the war’s epicenter—had changed. Our project brings to light some of the changes that Holland faced. We created an online exhibit that explores previously unknown sources, experiences, and events of World War I. Our goal was to share our findings with the community today. On the 100th anniversary of the United States’ entry into World War I, it is especially valuable to look at local history and see how our predecessors dealt with the largest war the world had ever seen.

#### “The Will to Win”: How the Fraternal Society Built Hope College Athletics

**Joey Williams**

Mentor:

Dr. Jonathan Hagood,  
*History*

Over the course of its history, the Fraternal Society has been both controversial and prolific. The Fraternal Society and other Greek fraternities are often viewed as a scourge to the campus life of colleges, particularly on the campus of a small Christian college like Hope. However, historical research reveals that, in fact, the impact that members of the Fraternal Society have had on campus is wide-reaching and diverse. This paper argues that, throughout its history and up to today, the Fraternal Society, or “Fraters”, has been fundamental to the development and success of Hope College athletics.

**The Interest of Spanish  
Young People on the  
Spanish Civil War  
(1936-1939) and  
the Franco Regime  
(1939-1975)**

**Alondra Monrroy**

Mentor:

Dr. Berta Carrasco,  
*Spanish*

*This research was supported  
by the Yntema Family Faculty  
Development Fund, part of  
the Nyenhuis family of funds.*

The Spanish twentieth century was marked by three main political events: a Civil War (1936-1939), a dictatorship (1939-1975), and a return to democracy (1975 until today). The Civil War was brutal and is remembered as a war of brothers against brothers. This combat affected that generation and the ones that followed. After this civil war, Francisco Franco maintained the dictatorship for 37 years until his death in 1975. Ideologically, Franco believed that Spain was the country chosen by God to fight communism, socialism, and masonry. As in every dictatorship, people were forced to follow this ideology and show tribute and respect to the dictator. Today, 41 years later, Spain enjoys a stable democratic system. However, we believe the aftermaths of three years of war and 37 years of dictatorship are still present in Spain's daily life and values. In this research, we analyze how the new generation, the "Post Millennial", understands and values these historic and social events. This new generation is considered the great- grandchildren of the Spanish Civil War and is thought to be one that knows very little about this historic moment and is not curious, nor interested in how these events altered the Spanish history.

## ARTS & HUMANITIES

### MUSIC

#### Sound Synthesis Methods: A Historical, Technical, and Musical Study

**James Fixx**

Mentor:

Professor Drew Elliot,  
*Music*

The objective of this research is to collect a broad range of information on sound synthesis and present it in a concise manner. This study will resemble an evolutionary tree, tracing the development of sound synthesis technologies through time as they build on previous innovations to create new methods of producing sound. A variety of historically significant and influential instruments will be investigated, with particular areas of focus being their respective inventors, their modes of operation, and the nature of the sounds they produce. The techniques to be researched fall into four categories: early electrical instruments (early to mid-20th century), early analog synthesis (circa 1960-1980), hybrid digital and analog synthesis (mid-1970s to present), and digital synthesis (early 1980s to present). The study will culminate in a contextual understanding of sound synthesis as it exists today and what the future may hold for this field.



**Production  
Management of  
*How I Learned to Drive*  
and *Theory of Grape***

**Gracen Barth**

Mentor:

Reagan Chesnut,  
*Theatre*

This project will show the process of production managing two separate student theatre productions, *How I Learned to Drive* and *Theory of Grape*. Production management involves overseeing every technical aspect of a theatre production, coordinating spaces and resources between productions, keeping in contact with faculty members, and running production meetings. This presentation will include meeting notes, formal reports, and the production calendars.

**Costume Design  
for *SHILOH*: A  
Devised Piece**

**Katrina Dykstra**

Mentor:

Professor Michelle Bombe,  
*Theatre*

The Play *SHILOH* is set in 1860's Texas in a town populated by women and runaways and is a matriarchal society in a patriarchal world. This peaceful town is interrupted by three outsiders and a long lost ruby, throwing their utopia into a panic. To design the costumes, I first conducted extensive research in the clothing of the period. Then I chose to look at my research and begin to create a design for these two worlds, I have chosen to populate one world with earth tones: mossy greens, and black. The outside world is filled with warm browns, reds, and other bright tones. Pants made of floral calico turn period fashion on its head; giving the women the freedom to move and fight. Overall, the clothing gives freedom of expression and movement to both the women and the men who live in this historic world.

**Stage Managing  
*SHILOH*:  
A Devised Play**

**Nathan Gingrich**

Mentor:

Reagan Chesnut,  
*Theatre*

The project will show the process of stage managing *SHILOH* 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.

## ARTS & HUMANITIES

### THEATRE

#### Making *The Theory of Grape*

**Alexander Johnson**  
**Elizabeth Stuart**  
**Victoria Ward**  
**Gabriel Swanson**  
**Kelsey Davis**  
**Timothy Embertson**  
**Maria Brouwers**

Mentor:

Professor Daina Robins,  
*Theatre*

The work that is being shown is the compilation of our full process in creating this new theatre piece, *The Theory of Grape*. The script was written in the previous year and in the present year the play has seen full artistic completion. The playwriting, directing, sound design, and properties design were done by senior Alexander Johnson. Senior Elizabeth Stuart completed the stage management, scenic design, and costume design aspects of this project. The role of producer was shared between Johnson and Stuart. The production was performed on March 8-10, 2018. The items that will be displayed at this poster session will be design concepts, drafts of the script, a model of the set, photos of the production, and other paperwork pertinent to the production.

#### Costume Design for Hope College Theatre

**Kierney Johnson**

Mentor:

Professor Michelle Bombe,  
*Theatre*

Theatre, specifically costume design, requires much research and a strong work ethic. The depth and specificity needed to create even a loose representation of a period of history or a concept or an abstract idea within a piece of clothing can only be described as monumental in scope. Design requires the presentation of creative ideas that while thorough and well supported must also be malleable enough to collaborate with a director's interpretation of the play. A costume designer requires the skill set of creative thinking, collaborative communication, and thorough research abilities that enables a successful finished design as well as future professional capability.

#### *In the Wake* Play Research

**Rachel Kennedy**

Mentor:

Professor Richard Perez,  
*Theatre*

This abstract is not available online.

## *The Miser* Dramaturgy

**Olivia Lehnertz**

Mentors:

Dr. Daina Robins,  
*Theatre*

Dr. Anne Heath,  
*Art*

*The Miser*, a five-act comedy written in prose by the French playwright Molière, has long been considered one of the greatest comedic plays in theatre history. It tells the story of penny-pinching Harpagon, a man who loves nothing more than his beloved cash box—not even his own children. Through manipulation, quick wit and comedy, Molière’s timeless piece explores the humorous and ultimately isolating impact greed can have on an individual while also commenting on the crazy things we do for love. As the dramaturg of Hope Theatre Department’s production of *The Miser*, I did extensive research to inform the work of the actors and designers of this production as well as provide helpful information to the audience through lobby dramaturgical boards. My main objective was to make sure our production was as true to the time period as possible, while also connecting this work that was written in 1668 to the present day to make it relatable for our audience. I did this by first creating a dramaturgical protocol that included a biography of Molière, as well as information about his comedy and the kinds of characters in his plays, exploration of the most important theme in the play (greed), vocabulary lists for unfamiliar words in the script, as well as pronunciations, images of inspiration, and other information regarding the style of French neoclassical comedy. I used this information to help actors refine their physicality to be less modern and more true to the time period as well as provide inspiration to the designers. I also created lobby dramaturgical boards that provided the audience with information about the playwright, style of comedy, as well as France under the reign of King Louis XIV, the setting and time period in which the play takes place. To connect the production to the present day, I decided to explore the concept of greed further. From research I obtained from various Internet sources and studies, I digitally created two infographics, one entitled “What Does It Mean to Be Wealthy?” and the other “Saving and Spending in America.” I wrote a program note for the audience as well, in which I explored why this play and Molière’s unique style are so timeless. Ultimately, this research and the presentation provided useful information that contributed to the overall success of the production.

## Stage Managing *The Glass Menagerie* by Tennessee Williams

**Makeya Royer**

Mentor:

Reagan Chesnut,  
*Theatre*

The stage manager is a role that requires organizational skills, composure, and confidence to help a production run smoothly. In February of 2018, Hope College put *The Glass Menagerie*, by Tennessee Williams, on their stage. I accepted the role of stage manager and began my work immediately. My job was to organize and lead production meetings, run rehearsals, gather and share information, and keep everyone involved in the process updated and informed. This project will show stage management documentation of *The Glass Menagerie* from the beginning of the production to the end.

# ARTS & HUMANITIES

## THEATRE

### *Human Error Stage Management*

**Emmie Sandstedt**

Mentors:

Professor Reagan Chesnut,  
*Theatre*

Professor Richard Perez,  
*Theatre*

This process is the documentation of bringing Eric Pfeffinger's *Human Error* to the Dewitt Studio Theatre stage, through the lense of a stage management process. A stage manager is one of the main communicators between actors, technicians, the production team, and the director. The stage manager is responsible for running rehearsals, production meetings, leading assistant stage managers, and "calling the show," or calling into action sound and light cues.

### *The Stage Manager and an Original Play*

**Izzy Schonfeld**

Mentor:

Dr. Daina Robins,  
*Theatre*

*This research was supported  
by the Hope College  
Department of Theatre.*

Every theatrical production requires the dedication of a good stage manager. This position requires someone who will be organized, communicative, and punctual. The process begins for a stage manager even before the first rehearsal. He or she must read and analyze the script, correspond with the director, and prepare for auditions. Additionally, the stage manager must plan production meetings where he or she will facilitate discussion between the director and design team. Proper paperwork is necessary to be produced by a stage manager so designers are prepared for the development of the production. Then, as rehearsals begin, it is the stage manager's duty to ensure that time is used effectively and all departments are kept up to date with the director's and actors' needs. This research goes into further detail not only about the stage manager's role within a theatrical production, but also the added difficulties that come with working on an original play. Oftentimes with new work, the playwright is in the room which may lead to changes in the script. These changes must be recorded by the stage manager and relayed to the design team. Finally, this research outlines the complications that may arise when the stage manager has multiple roles within a production, namely, producer and lighting designer.



## Honey Batcher

**David Wang**  
**Timothy Doorenbos**

Mentors:

Matt Gira,  
*Hope Entrepreneurial Institute*

Mary Ellen Kettelhut,  
*Hope Entrepreneurial Institute*

*This research was supported  
by the Hope Entrepreneurial  
Institute*

Honey Batcher seeks to enhance everyday photography by creating solutions that allow users to quickly share the perfect moment. Honey Batcher is a program that allows photographers to save hours of time in post processing by taking thousands of unorganized photos to a selection of the best moments from a certain shoot using neural networks to learn personal preferences.

## ParkShark: Using Carbon-based Painted Inductive Loops to Track Parking Space Occupancy

**Stephen Wilbur**  
**Jordan Hooker**  
**Holden Dippel**

Mentor:

Mary Ellen Kettelhut,  
*Center for Leadership*

ParkShark is modernizing and simplifying the way drivers find parking. Its flagship product is unique non-intrusive road mounted sensor that allows for the detection of vehicles within parking spaces. By partnering with businesses, universities and cities, Parkshark provides a way for drivers to easily find an available parking space while also providing information on length of stay and other factors to the parking space proprietors.

**Raising Lazarus:  
Reconstructing the  
Divine Office of a  
Medieval Saint**

**Jonathan Bading**

Mentor:

Dr. Anne Heath,  
*Mellon Scholars*

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

We hear very little of Lazarus of Bethany, the biblical figure resurrected by Christ in the Gospel of John, following the account of this miracle, one which foreshadows the resurrection of Christ himself. The Eastern and Western branches of the Church esteem him as a bishop-martyr, but for different reasons, in different places, and to different extents.

As expressed through the medieval hagiographical tome *The Golden Legend*, Catholic tradition takes Lazarus and his sisters Mary (Magdalene in the medieval mind) and Martha to the coast of southern France, where Lazarus served as first bishop of Marseille. His cult, bolstered by the widespread veneration of his two sisters, flourished in small pockets throughout France, some communities hailing him for his eventual martyrdom, others for his episcopacy.

In the summer of 2017, with grants from the Andrew W. Mellon Foundation, I researched the cult of Lazarus at the Benedictine Abbey of the Holy Trinity in Vendôme, nestled in the eastern edge of the Loire Valley, a wealthy and influential monastery famous for its relic, *La Sainte Larme*, the “Holy Tear” that Christ shed before the tomb of Lazarus. By translating the text and transcribing the music of the Office of Saint Lazarus, I discovered that the abbey centered its liturgical celebration of Lazarus upon the saint’s biblical role, gradually narrating the Gospel account with each antiphon and integrating his resurrection into the Office’s modal progressions and melismas. From there, I recorded my performance of these antiphons and put text, music, and audio into a Scalar digital essay with my faculty mentor, Dr. Anne Heath. At Vendôme, Lazarus’s Office exemplifies a complete and rich liturgical tradition, connecting a saint’s historic, biblical account to his localized veneration in medieval France. Moreover, his Office contains deep Christological underpinnings, unique to the abbey that held not the relics of Lazarus, but the tear of Christ himself.

**Spontaneous  
Emotional Searching:  
A Contemporary  
Analysis of  
Humanistic Action**

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

*This project was an interdisciplinary endeavor between the Department of Art and Art History and the Mellon Scholars Program. See page 6 in the art & art history section of this book for full abstract.*

## Human Rights Violations of Detained Family Units

**Alejandra Gómez  
Limón**

Mentors:

Dr. Virginia Beard,  
*Political Science*

Dr. Anne Heath,  
*Mellon Scholars*

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

How do detention centers in the US and UK violate the human rights of detained family units? How does the detention of immigrant family units a violation of their human rights in the US and UK? This research will investigate if and how human rights discourse and immigration come together in detention of both legal and undocumented immigrants, comparing two Western countries with significant conflict surrounding immigration.

## MultiGenre Creative Writing Project

**Anna Jones**

Mentor:

Dr. Susanna Childress,  
*English*

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

This project will highlight creative writing in a digital format. It will include pieces that have been worked on in the MultiGenre Creative Writing course in which I have been enrolled during the Spring 2018 semester. Pieces will include creative works from various and hybrid genres, organized in an accessible way to create a database that can be viewed as an online chapbook for these selections of writing.

## The Second Classroom: A New Lesson Plan on Masculinity in Children's Media

**Nina Kay**

Mentor:

Dr. Kendra R. Parker,  
*Women and Gender Studies*

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

Stories focused around a male bildungsroman, a male character who is coming of age, are one of the most popular genres of storytelling and make up the bulk of story-based media children in western society consume. The male bildungsroman character is pervasive and current children's animated television is no exception. However, the male bildungsroman that is occurring in contemporary children's animated TV diverges from its predecessors, for the better. The traditional male bildungsroman story that has occurred throughout literary history has been problematic in nature. This type of narrative has been used to reaffirm and socialize children, (mainly adolescent males) into adhering to patriarchal ideals. Ideals such as "Don't be female," "Be aggressive," and "Be sexual" (Wood 174-176). The three contemporary children's animated TV shows examined in this study, Gravity Falls, Star vs The Forces of Evil, and Steven Universe all have their own male bildungsroman character. But each show in their own way is rejecting and reworking the traditional male coming of age story. To explore these TV shows, I used an intersectional feminist approach. These three shows were chosen for the study based on their progressive nature and the fact that all have been extremely popular with child audiences. To complete this study, I watched every episode of Gravity Falls, Star vs The Forces of Evil, and Steven Universe that premiered on TV during between 2012-2016, for a total of 194 episodes or 43.3 hours of content. This particular essay focuses on the data and commentary that relates to the male coming of age story arch. It is my argument that Gravity Falls, Star vs The Forces of Evil, and Steven Universe reworked the male coming of age story arch, and this divergence may have the ability to reshape how entire generations of American children comprehend masculinity.

## Songs That Speak to Us

**Ellen Messner**

Mentor:

Dr. Julia Randel,  
*Music*

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

Throughout our life we are exposed to an incredible quantity of music. Of all of the music we hear, however, there are only a few that we consider to be our favorites. To explore how music preferences are formed, I conducted a series of informal interviews with four residents of Holland, Michigan. Though most indicated that they found it difficult to define their "favorite" music in specific ways, each interviewee identified that the music that speaks to them is associated with important people or events in their life. Within this context, we see how cultural environments shape our emotional connections with music.

**She’s Taking Over:  
#SophiatheRobot and  
Doomsday Humor**

**Sarah Herrera  
Aine O’Connor  
Mitch Van Acker**

Mentor:

Dr. Marsely Kehoe,  
*Mellon Scholars*

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

When you picture an alien invasion, what do you see? Probably UFOs, green creatures with misshapen heads, or a massive panic across the world. But what if we told you they’re already here?

One of them, that is. Its—or, according to many people on Twitter, her—name is Sophia the Robot, created by Hanson Robotics in Hong Kong, introduced to the world in 2016 in Texas, and a recently naturalized Saudi Arabian citizen. Sophia is quite the world traveler, and the robot’s impact has been instantaneous and swift. Across the planet, people are sitting up and taking notice of what might be the most lifelike artificial intelligence ever created. Our project looked at this reaction, specifically the humor surrounding Sophia on the social media platform Twitter. We used a representative sample of humorous tweets about Sophia to see if it is part of the “uncanny valley,” a phenomenon within AI where a human-like robot causes feelings of revulsion rather than empathy. Are you prepared for a world where our self-created aliens are a norm rather than an aberration?

**American Womanhood:  
How Historical Context  
and Toni Morrison  
Inform Representation  
of Black and White  
Womanhood in  
*The Help* and its  
Film Adaptation**

**Gianna Ramirez**

Mentor:

Dr. Curtis Gruenler,  
*English*

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

In her 1992 publication, *Playing in the Dark*, Toni Morrison presents her arguments about the directionality of America’s most difficult conversation and her critique of the literature that attempts to enter it. Having at one point acknowledged that writers often unknowingly insert their social environments into their work, Morrison’s interest in how that insertion becomes a manifestation of other’s stories and battles secret wars, catapults her into a discussion of American racialization. A combination of binary deconstruction and a critique of post-colonialism imperialist nostalgia, Morrison’s American Africanism seeks to answer the question of why the Africanist persona has been constructed the way it has and who is implicated by its continual use. Her close examination of the interpersonal and dependent relationship between white and black in American culture inspires a new understanding of how racialization not only impacts the victim, but also those who perpetuate it. In line with Morrison’s focus on deconstructing the binary, Kathryn Stockett’s *The Help* utilizes the mammie archetype and iconography to express the dependent relationship between blackness and whiteness. In examining Kathryn Stockett’s *The Help* and its film adaptation through Morrison’s understanding of binary deconstruction and imperialist nostalgia, it becomes clear that *The Help* is commenting on the historic impact of racialization on both the construction of black womanhood and white womanhood.

### The Civil War and Racism

**Krisia Rosa**  
**Emily Wolfe**  
**Michael Bernard**

Mentor:

Dr. Marsely Kehoe,  
*Mellon Scholars*

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

History is often told from the dominant culture's perspective, especially in United States history. Thousands of stories have been lost over the years due to a lack of interest or because of prejudice. Our goal has been to uncover lost stories from the Civil War and the Vietnam War through analyzing letters of both black and white soldiers from the Joint Archives of Holland and the National Archives. We have taken a special interest in how the United States has made strides to overcome racism in the military from war to war. Our findings suggest that there was a significant difference in how black and white soldiers experienced each war. While prejudice against black soldiers appears to have lessened as the military evolved, there is still so much more work to be done within the United States Military to create an accepting and respectful environment for all members. Above all, we have found value in telling history from the many perspectives and stories that were lost.

### The Effects of Calvin VanderWerf's Presidency

**Emma Wangstrom**  
**Rebecca Stanton**  
**Holle Wade**

Mentor:

Dr. Marsely Kehoe,  
*Mellon Scholars*

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

Dr. Calvin VanderWerf, eighth president of Hope College from 1963 to 1970, became president during a time when the world was changing. Our research shows that VanderWerf responded to and engaged with this period of growth by making major changes to the college, which are still present today. In our research, working with the documents at the Joint Archives of Holland which were collected from VanderWerf's presidency, we focused on the changes made to the chemistry department, the Black Student Coalition, and Hope's student-run newspaper, The Anchor. We found that the chemistry department was adding new faculty and changing to a more researched-based discipline. Black students on campus started a coalition and faced many hardships while trying to create their identity at Hope. Our research also revealed that VanderWerf had extensive correspondence with the staff of The Anchor concerning questionable journalistic ethics, and he initiated changes to the newspaper's policies which affected its relationship to the college up to today. We believe this research is important so that we, as a college, can look at the progress we have made and see if things need to be changed or further developed. We found that the changes President VanderWerf made to the College are still effective today and were built upon even after his time as president was over.



## Media Outlets and Black Lives Matter on Twitter

**Madeleine Zimmerman**  
**Cherish Joe**  
**Carolyn Wetzel**

Mentor:

Dr. Marsely Kehoe,  
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*This project was supported  
by the Andrew W. Mellon  
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The Black Lives Matter movement was started in 2013 in response to the acquittal of Trayvon Martin's killer, George Zimmerman. The movement has gained a lot of momentum through social media outlets, such as Twitter, using the hashtag #BlackLivesMatter. This project looks at the portrayal of the movement through the usage of the hashtag on Twitter, specifically from 2015 to 2017 by two major news source accounts, CNN and Fox News. We chose these two news sources in order to gain perspective from both sides of the political spectrum, as CNN is, from our perspective, more left-leaning, and Fox News is more conservative. We chose a percentage of tweets from each account pertaining to Black Lives Matter and looked at retweets, likes, and responses for each tweet. Our group created operational definitions for the various themes that stood out in the original tweets and the responses by the news sources in order to gauge a general understanding of the representation of the Black Lives Matter movement by the public on Twitter. Based on the operational definitions that we assigned to the content of each tweet for both CNN and Fox News, this project aims to determine sentiment responses from these news sources pertaining to Black Lives Matter in order to critique the fact that the difference in the presentation of opinions affect viewer opinion and response.

### Behavioral Effects Following Ablation of Retinal Ganglion Cells in Diurnal Grass Rats

**Garrett Fogo**

Mentor:

Dr. Andrew Gall,  
*Psychology & Neuroscience*

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by the Donald W. Cordes  
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of funds.*

Light influences behavior and physiology in mammals through the entrainment of circadian rhythms, along with direct and acute inhibition or stimulation of activity, a process called masking. Although there has been substantial progress elucidating the mechanisms responsible for the workings of the circadian system in nocturnal species, less is known about the mechanisms that support the mammalian diurnal profile of activity, especially as they relate to the retina. We recently showed that the intergeniculate leaflet (IGL) is critical for the display of normal patterns of daily activity in diurnal grass rats (*Arvicanthis niloticus*). Specifically, IGL lesions reverse the activity patterns of these animals such that they became night-active; this occurred through their effects on both circadian mechanisms and masking. The IGL is a thalamic structure that receives direct inputs from the melanopsin containing intrinsically photosensitive retinal ganglion cells, known as ipRGCs. Our current approach takes advantage of a diurnal mammalian model, the Nile grass rat, to test the novel hypothesis that melanopsin is critical for the expression of diurnal behavior and physiology, and is involved in masking responses to light. The present study utilized intraocular injections of N-methyl-D-aspartic acid (NMDA), an excitotoxic chemical that destroys retinal ganglion cells while keeping ipRGCs intact. Animals were placed in various lighting conditions, including 12:12 light-dark conditions, and given pulses of light to test for effects of masking. Controls were significantly more active during the lights-on phase, consistent with a diurnal species. Animals with NMDA injections were still be able to entrain to light, but image-forming vision was significantly impaired. Altogether, we are building a model to understand the mechanisms underlying the normal display of diurnal behavior, and we hope to add to this knowledge by examining how melanopsin contributes to the display of diurnal behavior in grass rats.

## Prepubescent Behaviors and Circadian Rhythmicity in an Animal Model for Bipolar Disorder

**Ryann Felton**  
**Garrett Fogo**  
**Sarah Plowman**  
**Nicholas Rozema**  
**Tymi Staub**

Mentor:

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*This project was funded by  
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Approximately three percent of the world's population suffers from Bipolar Disorder (BPD), a psychiatric disorder that is characterized by manic and depressive behaviors as well as abnormal sleep-wake patterns (Jones, 2012). Although there has been extensive research on BPD, an animal model with face, construct, and predictive validity, has yet to be established. We hypothesize that the administration of homocysteic acid (HCA) to rat pups will result in an animal model phenotypically similar to human BPD. The primary goal of the current study is to validate HCA administration as a model for BPD. Additionally, this study aims to examine and compare the behaviors of HCA treated rats prior to and after puberty. In the present study, behavior and circadian rhythms were analyzed in rats injected with HCA or saline solution from postnatal days (P)3-21. Rats were tested in the elevated plus maze, saccharin preference test, and open field test in order to analyze risk-taking behavior, anhedonia, and anxiety before and after puberty. To further validate the proposed model, rats were singly housed in cages with infrared sensors that detect their activity level under various lighting conditions. We predicted that HCA treated rats would exhibit significant changes in circadian rhythms and behavior, similar to organisms with symptoms of BPD. We have found that rats given HCA exhibit a significantly shorter period in constant darkness, suggesting that circadian rhythms are disrupted in this BPD animal model. In order to effectively treat patients and acquire a better understanding of BPD, it is crucial to explore multiple techniques that would replicate the symptoms observed in BPD patients.

### Impact of Obesity and Diet: Obesity Development Leads to Selective Manifestation of Anxiety-like Behaviors in Obesity-Prone Rat Populations

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**Spencer Morgan**  
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*Supported in part by the  
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Anxiety disorders are the most prevalent mental disorders in the United States. In addition, it is well known that obesity continues to develop as an increasing problem in the US, generating many socioeconomic and physiological concerns. A correlation has been shown between anxiety and obesity, however, the exact relationship between body weight and anxiety remains poorly understood. While several studies have been conducted to look at the correlation between anxiety and obesity, a physiological link has not been as well investigated.

Here we demonstrate that outbred rats placed on either chow, junk food, or high fat diets do not exhibit differences in anxiety-like behavior even after significant weight gain. However, selectively bred obesity-prone rats did show elevated anxiety-like behavior after the onset of obesity compared to obesity-resistant rats. These data, combined with data demonstrating that obesity-resistant rats forced to gain weight do not develop anxiety, suggest that a combination of both predisposition and obesity development are necessary to cause anxiety-like behaviors, while diet and obesity are not independently sufficient.

Moving forward we hope to build on our understanding of the relationship between obesity and the HPA axis. Data presented here begins this investigation by examining plasma levels of corticosterone as an indirect measure of HPA axis activation. Further studies are planned to investigate the role of corticotropin-releasing-factor receptor 1 (CRF-R1), a precursor within the stress pathway, and its role in the development of anxiety-like behavior in obesity. More specifically, we will evaluate CRF-R1 expression changes in brain regions likely involved in obesity and over-eating, including the nucleus accumbens (NAc) and prefrontal cortex (PFC). Heightened expression of CRF-R1 have been observed independently in studies of both anxiety and obesity making it a possible link between the two conditions. Thus, examining the CRF system and the effects of a variety of diets, as well as obesity development, on these systems could improve our understanding of the role of diet and or obesity on the development of anxiety-like behaviors.

## Establishing the Predictive Validity of a Novel Animal Model for Bipolar Disorder

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**Ryann Felton**  
**Julia Berlin**  
**Samantha VanHoven**  
**Mercedes Rede**  
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**Fall 2017 Introduction to Neuroscience Lab**

Mentors:

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

Previous work in our laboratory has 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 saccharin 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. Our preliminary results suggest that ketamine is effective in reversing the effects of HCA on three of four depressive markers: social interaction, spatial memory, and escape behavior in the forced swim test. Ketamine did not, however, reverse the anhedonia observed by HCA-treated rats in the saccharin preference. Thus, ketamine was mostly effective against the depressive phenotype and had no effect on the manic behaviors.

## Establishing the Validity of a Novel Animal Model for Bipolar Disorder through Neurochemical Analysis

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Mentor:

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*This study was funded by the Hope College Neuroscience Program, the Hope College Departments of Biology and Chemistry.*

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 previously tested the hypothesis that elevated HCA levels in developing rats may induce a bipolar-like phenotype. We observed that 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. To better understand the molecular correlates of these behavioral changes, in this study we assessed the effect HCA treatment on NMDA and GABAergic markers, as NMDA-expressing GABAergic interneurons have been suggested to be improperly gated in bipolar disorder. 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. 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. In addition, we observed that HCA signaling led to profound reduction myelination markers which is consistent with post-mortem studies of bipolar patients. Collectively, these results suggest that early postnatal exposure to HCA may serve as a novel animal model for studies of complex mood disorders, such as bipolar disorder.

## Evaluating the Impact of a Latent Infection of Herpes Simplex Virus Type I on Behavior in Two Different Strains of Mice (*Mus musculus*)

**Isaiah Hough**  
**Emily Kain**  
**Aubrey LaVoie**  
**Nicholai Shaw**

Mentor:

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*Neuroscience*

Seventy percent of the US population is infected with Herpes Simplex Virus Type I (HSV-1). Additionally, more than one-third of the US population is seropositive for HSV-1 by the age of sixteen. Prior research has indicated that HSV-1 infection is correlated with diminished working memory in children and adults. Yet, to our knowledge, no one has tested for a direct causation of HSV-1 in impairing memory. In light of this knowledge gap, we hypothesized that a latent infection of HSV-1 would reduce working memory performance. To test this hypothesis, we inoculated C57/BL6 and BALB/C mice with the F strain of HSV-1 via cornea scarification. Next, the virus was allowed to initiate and maintain latency for 45 days in the mice before a battery of behavioral tests were commenced. The open field test was administered to the mice to evaluate locomotive and exploratory behaviors. A modified version of the Morris water maze was conducted to evaluate working memory in the spatial navigation realm. Additionally, mice underwent the novel object recognition test to working memory in a manner less dependent on spatial cues. Lastly, an alternating t-maze was utilized to test working memory. So far, results have indicated that the mice latently infected with HSV-1 took a longer amount of time (and traveled a greater distance) before entering the center region of the open field test, compared to uninfected control mice ( $p < 0.05$ ). The analysis of results from other behavioral paradigms are ongoing. Thus far, our preliminary results indicate that HSV-1 latency, a period in which the virus does not actively replicate, modulates behavior—specifically causing animals to become more risk-averse.

## The Protection of Our Youngest

**Jamie Breyfogle**

Mentors:

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*Phelps Scholars*

Professor Yolanda Vega,  
*Phelps Scholars*

Child abuse is an occurrence which is difficult to identify and prosecute. This is especially true when it comes to abuse perpetrated by a child's parents. Even the definition of child abuse varies between sources and between countries and is different for a child's parents than it is for a stranger. Government bodies are often hesitant to get involved in situations that involve a child and their parents because the family's right to privacy was established before a child's right to safety. This research seeks to analyze the definition of child abuse, or lack thereof, in different countries, in addition to incorporating a more local approach to the definition of child abuse. Additionally, the research will discuss current methods of investigating and prosecuting child abuse and their effectiveness and uncover some of the particular difficulties associated with identifying and prosecuting child abuse that is perpetrated by parents. Finally, several possible solutions will be presented from both a national and international viewpoint.

## Where Did the Middle Go?: The Disappearance of the Middle Class

**Taylor Calloway**

Mentors:

Professor Kristen Gray,  
*Counseling and Psychological  
Services*

Professor Yolanda Vega,  
*Phelps Scholars*

Economic inequality has been an integral part of the socioeconomic strand of America. The idea that the wealthiest 1% of Americans owns 95% of the national wealth is the very core of America's fragile economy. The same can be said about the international inequality of wealth overall. The disappearance of the middle class in our current economy is clear from all that we hear in the news. The possibility that the world's richest nation could have such a large inequity of distributed assets among the population is shocking to people on a global scale. When the world's richest nation suffers severe economic setback, so does the global economy. Our economic trials are focused on the increasing wealth gap, the lack of feasible retirement accounts, and the inequity of investment and everyday shareholding. This research focuses on the national lack of financial education and how increasing living expenses means a national socioeconomic neglect of middle class families nationally and globally. The research also focuses on the definition and redesign of our current middle class and why it should be saved.

## Poverty, Race, and Education: the Intersectionality of a Minority Student

**Samuel  
Cervantes-Esparza**

Mentors:

Dr. Charles Green,  
*Psychology*

Professor Yolanda Vega,  
*Phelps Scholars*

Education is thought to be a right given to all children, and it is. However, the quality of education is not the same for all students. A student's race and socioeconomic status determine both the type of education they receive and how much education they can obtain. Race, poverty, and education are all interconnected in the life of a minority student. Intersectionality is the overlap of social identities that a person may assume or be ascribed that can place them at a disadvantage. According to the National Commission on Teaching & America's Future, "new teachers hired without meeting certification standards (25 percent of all new teachers) are usually assigned to teach the most disadvantaged students in low-income and high-minority schools, while the most highly educated new teachers are hired largely by wealthier schools." This is one example of how race and economic class play a significant role in the type of education students receive. This presentation explores the intersectionality of race, poverty, and education at both a global level and a local level using both a sociological and a personal lens

## INTERDISCIPLINARY PHELPS SCHOLARS

### Is HIPAA Beneficial to Patients?

**Nolan Krause**

Mentors:

Dr. Charles Green,  
*Psychology*

Professor Yolanda Vega,  
*Phelps Scholars*

Do you value your medical privacy? HIPAA, the Federal Health Insurance Portability and Accountability Act, ensures that all of your medical files, EMR's (electronic medical records) or otherwise, are secure. This law was signed by President Bill Clinton in 1996 with the goals of protecting health care coverage for citizens, increasing regulations on security of patient information, and reducing the burden associated with the electronic transfer of health information. HIPAA has been in place for 21 years now and is taken quite seriously by medical professionals in the U.S. There are many advantages of this law, including protection of medical records, quick accessing of medical records, and confidence to trust the medical system with intimate patient details. However, HIPAA does inhibit the availability of global medical tourism. The restrictions of HIPAA on medical record security make it difficult for patients seeking treatment in other nations, which could frustrate patients trying to get lower-priced procedures not available in their home country. I believe that HIPAA secures accurate details, saves time, and is beneficial to patients, despite its effect on medical tourism.



## Where Are You Wearing?: A Global Perspective

**Kaelyn Poirier**

Mentor:

Professor Yolanda Vega,  
*Phelps Scholars*

Most of the clothing found within the United States of America comes not from the country itself, but from many other countries around the world. Countries such as Bangladesh, Cambodia, and China contribute greatly to the clothing industry, especially for America. Ninety-seven percent of clothing is made outside of the U.S., with the average t-shirt traveling at least one time around the world before landing on one's back. However, looking behind the scenes in these clothing factories, it is apparent that there are unsanitary work environments and an extensive number of hours worked for very low wages. The differences in the small amounts of clothing that are produced in America are seen clearly with workers being paid fair wages, not overworked, and enjoying extra benefits. It is vital to understand the importance of buying local and buying from brands that do not support the mass-production system of garment and manufacturing. While this research focuses mainly on the global perspective of the garment industry, it also acknowledges the local aspect in the U.S. and in Holland, Michigan. This research project explores the industry behind the big brands seen everyday in stores and the working conditions that need to change.

## Could Depression and Loss of Dignity Correlate with Requesting Euthanasia and Physician-Assisted Suicide? A Look at the Research from the United States, Canada, and the Netherlands

**Jana Sahyouni**

Mentors:

Dr. Charles Green,  
*Psychology*

Professor Yolanda Vega,  
*Phelps Scholars*

Euthanasia and physician-assisted suicide are legal in the Netherlands, Belgium, Luxembourg, Colombia, and Canada. Physician-assisted suicide alone is legal in Switzerland and within the U.S. in Oregon, Washington, Montana, California, and Vermont. Public support in the United States and the Netherlands for the "right to die" has steadily increased since 1950. This research seeks to uncover the underlying reasons that patients request euthanasia and physician-assisted suicide. Signs of psychological depression and loss of dignity appear to be the main reasons for considering euthanasia and physician-assisted suicide. In the United States, requests for euthanasia and physician-assisted suicide correlated most strongly with loss of autonomy, not being able to enjoy everyday life activities, and loss of dignity. In the Netherlands, more than half of euthanasia/physician-assisted suicide cases contained loss of dignity as one of the reasons. In Canada, the desire for death in the terminally ill was higher for people who had higher ratings of pain, lower family support, and depressive symptoms. Of these, depression is the best predictor of the desire to die. Palliative care that respects individual differences and psychological treatment that emphasizes the therapeutic alliance would provide people with more years of meaningful living.

## The Invisible Connection: Mental Health and Sexual Assault

**Andrea Shumaker**

Mentors:

Dr. Llena Chavis,  
*Social Work*

Professor Yolanda Vega,  
*Phelps Scholars*

One in six women are sexually assaulted at least once in their lifetime. One in five U.S. adults experience mental illness in a given year. These two things are not mutually exclusive. Mental illness is prevalent across the globe and highly stigmatized. Resources to aid those suffering from an illness can either be hard to find or too highly stigmatized. Because of this, many mental health cases go unreported. Sexual assault is an extremely traumatic event that can be detrimental to a victim's mental and physical health. Thirty-one percent of rape survivors developed PTSD and eleven percent of those will carry that illness with them for life. Survivors who experienced mental illness pre-assault, are forced to deal with their illness re-entering their life after the assault. Many survivors report their illness becoming much worse after being assaulted. This research examines the relationship between these two experiences through a local and global lens.

## No Home? Hazardous!: Homelessness and Children's Emotional Health

**Anna Vostrizansky**

Mentors:

Dr. Charles Green,  
*Psychology*

Professor Yolanda Vega,  
*Phelps Scholars*

What is homelessness and how does it affect mental health? There are many definitions of literal homelessness, ranging from living on the street, in a car, in abandoned buildings, or in a shelter home. According to the U.S. Department of Housing, in 2016 there were 206,286 people living in literal homelessness, and nearly 60% of them were children. Numerous studies have demonstrated that homelessness affects the mental and emotional health of children. According to a study done by the Health Care for the Homeless Clinicians' Network, homeless children in a school setting will experience frequent illness, increased levels of anxiety, and have decreased attention spans compared to housed children. Children in other countries are also negatively impacted by homelessness. A study in the African country of Ghana examined the risk behaviors of homeless children between the ages of 8 and 19. Compared to housed children, homeless children were more likely to get involved in high-risk behaviors such as smoking cigarettes, being sexually active, and being injured in a fight. This study not only explains the impact of homelessness on children's lives, it also aims to spread awareness of this growing affliction for so many children all around the world.

## A Freak is a Freak is a Freak: The Real American Horror Story

**Kristen Szalontai**

Mentor:

Dr. Kendra R. Parker,  
*Women's and Gender Studies*

The television show American Horror Story is known for featuring controversial topics. From sexual assault and incest to demonic possession and exorcisms, it seems that each season provides something to make viewers intensely uncomfortable at best. Season 4, American Horror Story: Freakshow, is no exception to this trend. Season 4 is set in Jupiter, Florida in 1952, and looks at the lives of the performers at one of the last freak shows in the country. The show follows the “freaks” through their struggles to keep the freak show running while also looking at the various traumas they face. At first glance AHS: Freakshow seems to be an attempt to shed light on some of the horrors and injustices that people with disabilities have faced throughout history, while also staying true to the show’s horror genre identity. However, the show instead perpetuates the exploitation and othering of black, queer, and disabled bodies. AHS: Freakshow uses the struggles of minority groups as a way to both gain profit and perpetuate stereotypes, and ultimately passes it off as entertainment for mainstream society. This normalization of othering, directly or indirectly, by popular media has only made it easier for people to accept, justify, and perpetuate harmful caricatures of these groups and their consequences, resulting in the continued dehumanization and oppression of these people.



## Mutations in *MON2*, Which Encodes a Protein Implicated in Vesicular Transport, Affects Response to Exogenous Fatty Acids in Yeast

**Riley Draper**

Mentor:

Dr. Virginia McDonough,  
*Biology*

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Metabolism of exogenous fatty acids requires cells to take up, traffic, and molecularly respond to fed fatty acids. Our lab has determined that a mutation in *mon2* results in defective growth on the fatty acid 10-undecenoic acid. Like wild type cells, *mon2Δ* mutants are capable of normal response to the feeding of long chain unsaturated fatty acids (UFAs) by reducing transcription of *OLE1*, (which encodes the  $\Delta 9$  desaturase), and by reducing the accumulation of endogenously produced UFAs. However, wild type cells when fed 10-undecenoic acid will continue to express *OLE1* and increase their content of endogenously produced UFAs. In contrast, *mon2Δ* mutants do not differentially respond to the two fatty acids. Staining with a BODIPY-labeled fluorescent fatty acid analog indicates that there is a difference in localization/amount of the supplied fatty acid in *mon2Δ* cells compared to wild type cells. Thus, it appears that the *mon2* mutation decreases the cell's ability to differentiate between fatty acids, perhaps due to mislocalization of the fed fatty acid or regulatory proteins.

## Effects of Compounds Synthesized in Organic Chemistry on the Proliferation of T47D Cancer Cells

**Alyssa Goodwin**  
**Anne Sangliana**

Mentors:

Dr. Jeffrey Johnson,  
*Chemistry*

Dr. Maria  
Burnatowska-Hledin,  
*Chemistry & Biology*

This abstract is not available online.

## Effects of VACM-1/ Cul5 Gene Knockout on Cellular Prolifer- ation Using CRIS- PR-Cas9 Approach

**Joel Karsten**  
**Sarah Bonema**

Mentor:

Dr. Maria  
Burnatowska-Hledin  
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Biology*

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by the Schaap Endowment  
and Herbert H. and Grace A.  
Dow Foundation.*

This abstract is not available online.

## Development of a Rapid Screening Assay to Detect Trafficking-Defective Mutants of System $x_c^-$

**John Larson**

Mentor:

Dr. Leah Chase-Wallar  
*Biochemistry & Molecular  
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*This project was supported  
by the Hope College  
Department of Chemistry.*

System  $x_c^-$  is a membrane transporter that exchanges extracellular cysteine for intracellular glutamate. The transporter is a heterodimer of two subunits, a transport-specific protein, xCT, and a heavily glycosylated associated protein, 4F2HC. Recent studies in the Chase lab have shown that the cell surface expression of this transporter may be regulated by trafficking motifs localized to the C-terminus of the xCT protein. Currently, we use a cell surface biotinylation assay which is expensive and labor-intensive to measure relative cell surface expression of xCT. The goal of this project is to develop a fluorescence-based assay that will allow for rapid screening of potential trafficking-defective mutants of the transporter. A similar assay has been successfully employed to study trafficking behavior of the Cystic Fibrosis Transmembrane Conductance Regulator (CFTR) (Holleran, J.P., et al., 2012). This assay requires the construction of a fusion protein in which an extracellular fluorogen-activating protein (FAP) is attached to the N-terminus of xCT. Since, the N-terminus of xCT is intracellular, the FAP domain is linked to xCT through a single-transmembrane domain of the Platelet-derived growth factor receptor. Once the fusion protein is created and expressed recombinantly in a mammalian cell line, the xCT on the cell surface can be labeled in real time by adding a membrane-impermeable fluorogen which only will fluoresce when bound to FAP. The relative fluorescence of the sample can then be measured (or imaged using a confocal microscope). Finally, a membrane-permeable fluorogen can be added to label the total pool of expressed xCT protein, and the relative fluorescence can be measured again, thus allowing one to calculate the percent cell surface expression of xCT. This assay can be adapted to 96 well plates to allow for rapid screening of putative-trafficking defective mutants.

## Altered Metabolism and Mitochondrial Lipid Content Drive the Evasion of Apoptosis

**Kyle Ross**  
**Alexandra Wyeth**

Mentor:

Dr. Kristin  
Dittenhafer-Reed,  
*Biochemistry & Molecular  
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*This research was supported by the Hope College Department of Chemistry and Biochemistry, the Hope College Division of Natural and Applied Sciences, and the Dow Scholars Program.*

Mitochondria are the metabolic centers of the cell and critical players in initiating programmed cell death. Mitochondrial dysfunction and dysregulated apoptosis contribute to a number of disease states, including inherited mitochondrial syndromes, neurological disorders, and cancer. Critical to both mitochondrial function and apoptosis is the architecture of mitochondrial membranes. A mitochondrion is comprised of an inner and outer membrane composed of numerous phospholipids, including cardiolipin, a phospholipid found exclusively in the mitochondria. Cardiolipin binds to cytochrome c in the inner mitochondrial membrane, preventing its release and the initiation of intrinsic apoptosis. Defects in genes required for the maintenance of mitochondrial membrane structure and cardiolipin composition have been identified, and represent an emerging class of mitochondrial disorders. However, a detailed molecular understanding of the synthesis and regulation of mitochondrial membrane phospholipids is lacking. The overall objective is to investigate mechanisms of increased cardiolipin biosynthesis and to study the role of cardiolipin content and composition in regulating the initiation of intrinsic apoptosis. Cancer cells are often characterized by an increased dependence on glucose. These cancers are often resistant to chemotherapies, representing a significant clinical problem. Current research employing cellular phospholipid quantitation has identified that altered cellular glucose metabolism regulates cardiolipin synthesis. Further, the effects of altered cardiolipin levels on cell viability and cytochrome c release upon RNA mediated knockdown of cardiolipin biosynthesis enzymes were studied. Data acquired from cell viability and immunofluorescence microscopy assays suggest that knockdown of cardiolipin synthase (CRLS1) resulted in decreased cardiolipin levels, decreased cell viability after drug treatment, and increased cytochrome c release. Alternatively, loss of lysophosphatidic acid phosphatase type 6 (ACP6), hypothesized to increase cardiolipin levels, resulted in decreased cytochrome c release, which would also lead to increased cell viability. These results will allow for an increased fundamental understanding of cardiolipin physiology in order to uncover the therapeutic potential of targeting new mitochondrial pathways to treat human disease like cancer.

## Mechanisms of Regulation of Mitochondrial DNA Stability and Transcription

**Mackenna Senti**  
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Mitochondrial DNA (mtDNA) encodes for 13 protein components required for cellular respiration. While the critical roles of mitochondria in metabolism and cellular function are well established, the mechanisms regulating expression of genes encoded by mtDNA are poorly understood. mtDNA is complexed to proteins in structures known as nucleoids, complexes thought to promote mtDNA stability, protect mtDNA from damage, and potentially allow for transcriptional regulation. Proteins found in nucleoids include the core transcriptional and translational machinery and mitochondrial metabolic enzymes. The overall objective is to determine whether reversible post-translational modifications (PTMs) of nucleoid proteins, including acetylation or phosphorylation, regulate mitochondrial gene expression. Acetylation and phosphorylation sites have been identified in a number of nucleoid proteins, including mitochondrial ribosomal protein L12 (MRPL12), a protein required for promoter recognition and recruitment of the enzymes required for mtDNA transcription. Our central hypothesis is that PTMs affect MRPL12 function and provide a means of regulating mitochondrial gene expression. We will highlight our work on the characterization of MRPL12 PTMs. Specifically, we will focus on the cloning, bacterial expression, purification, and analysis of MRPL12. Site-directed mutagenesis was used to alter the amino acids known to be post-translationally modified to amino acids mimicking either the modified or unmodified amino acid. Purified MRPL12 mutants were used in transcription assays and mtDNA binding assays to determine the effects of these PTMs on MRPL12 function and mitochondrial gene expression. In addition, transcriptional changes and mtDNA content were measured in response to varying media metabolite concentrations and upon the genetic loss of Sirtuin 3, the primary mitochondrial deacetylase. Our hypothesis is that PTMs act as transcriptional switches capable of responding to the energetic status of the cell. Preliminary data suggests SIRT3 may respond to the energetic status of the cell by increasing mitochondrial transcripts following glucose deprivation.

## Activation of Akt Increases Cell Surface Expression of System x<sub>c</sub><sup>-</sup>

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and 1153600, the REACH  
program and the Koeppe-  
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System x<sub>c</sub><sup>-</sup> 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 H<sub>2</sub>O<sub>2</sub> in confluent U138MG human glioma cells. This study sought to begin to characterize the mechanism by which H<sub>2</sub>O<sub>2</sub> regulates xCT trafficking. We hypothesized that Akt signaling is necessary for H<sub>2</sub>O<sub>2</sub>-mediated trafficking of xCT. A significant increase in Akt phosphorylation was observed in U138MG cells following ten-minute exposure to 3 mM H<sub>2</sub>O<sub>2</sub> compared to vehicle-treated cells using western blot analysis. Treatment with the Akt inhibitor 10-DEBC (2.5μM) for 30 minutes prior to and during H<sub>2</sub>O<sub>2</sub> exposure resulted in a decrease in H<sub>2</sub>O<sub>2</sub>-induced phosphorylation of Akt at Ser473. Similar inhibition of Akt phosphorylation at Thr308 was observed following treatment of cells with 1.0μM API-2. Next, we used simultaneous treatment of cultured glioma cells with both inhibitors in the presence of H<sub>2</sub>O<sub>2</sub> 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 H<sub>2</sub>O<sub>2</sub>-induced trafficking of 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 to cells transfected with a dominant negative Akt. These data suggest that Akt is an important regulator of xCT cell surface expression.



Environmental Factors  
Affecting Bacterial  
Community  
Composition in  
Hypereutrophic  
Macatawa Watershed

This abstract is not available online.

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Project Based  
Learning: The Teachers'  
Perspectives

*This project was an interdisciplinary endeavor between the Department of Education and the Department of Biology. See page 100 in the education section of this book for full abstract.*

## Utilizing Community Voice to Guide the Design and Implementation of Institutional Responsiveness to the Flint Water Crisis

Ismael Byers

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In the years leading up to and following the Flint water crisis, community residents, activists and leaders mobilized to protest unjust policies and decisions that created and prolonged the ongoing crisis. The Flint community is challenged with issues of trust and mistrust as stakeholders are left without narratives coming directly from the community. There is a great importance in using the the community's voice as the most influential narrative to provoke institutional responsiveness. For this reason, flexible and dynamic processes are required to manage the flow of information, resources and organizing strategies to design new interventions in the community. Community-Based Organization Partners (CBOP), a grassroots organization representing over 40 partners in Flint and the Michigan Institute for Clinical and Health Research (MICHR), through whom this research was funded, formalized a relationship in 2007 to support equitable community-academic partnerships and community health priorities. The CBOP/MICHR partnership developed a portfolio of community-engaged research efforts in 2016 focusing solely on the crisis. These efforts will document community perceptions and support design of a research agenda driven by the community. This presentation will highlight lessons learned from three mixed methods research efforts using purposive sampling. Our analysis is contextualized in relationship to other approaches as best possible, however, unique domains guiding our work may be overlooked or not evident in existing literature and theory. Thus, we may be developing a new theoretical frame that could be valuable to other communities. This framework will define core theories and concepts recommended by the community to help rebuild trust and the quality of life in Flint, Michigan. Review of literature has shined a light on several strategies on conducting community based research in communities damaged by environmental crises such as the Flint Water Crisis. Through such literature and review of ones pertaining to theoretical frameworks, it is possible that a model can be developed for not only Flint but for other communities as well.

## Genomic Analysis of the Novel Mycobacteriophage Thyatira

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*Research supported by the  
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Twenty 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. 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, Thyatira, was chosen as one of two phages for complete genome sequencing and comparative genomic analyses. The predominant plaque produced by Thyatira after 48 hours at 32°C was circular and was approximately 5.5 mm in diameter. The complete genome sequence for Thyatira revealed a relationship to mycobacteriophages of cluster K, subcluster K5, which now contains 14 sequenced members. The genome of Thyatira is 63.7 Kb, making it the largest of all sequenced K5 mycobacteriophages. It has a GC content of 64.6%, similar to the host *M. smegmatis* (67.4%). Auto-annotation of the Thyatira genome indicates it contains 99 protein-encoding genes and a single tRNA gene. Phages in subcluster K5 share very high sequence identity throughout the genome lengths. Thyatira maintains this pattern, being nearly identical to mycobacteriophages OkiRoe, Paola, and Waterfoul despite their isolation in different years (5 year span) and in different geographical locations. A segment of DNA approximately 2.5 kb in length (genes 38-40), was found in the middle of Thyatira's genome that is unique to all sequenced mycobacteriophages to date, which could provide information on the phage's origin. 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.



## Wildlife Use Patterns in a Constructed Wetland

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*This research was supported  
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Center Macatawa Greenway  
and by the Hope College  
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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 native wildlife populations. However, this site is near Tulip City Regional Airport, which initially raised some concern over the potential for increased aviation collision risk with wildlife. Our study investigated the changes in wildlife use of the site before, during and after wetland construction in relation to the potential hazard that different animals may pose to aviation, and explored 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 abundance, activity, and aviation threat in each habitat type. Results indicate that seasonal increases in the hazard to aviation may be linked to recruitment of particular species in the new wetland, though overall these trends are minimal and wildlife is flourishing in the constructed wetland habitat.

Relating *Acer*  
Morphology,  
Phylogeny, and  
Historical Climatology

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*Acer* (Maples) is a plant genus with tremendous diversity in the Northern Hemisphere. Divided into nineteen taxonomic sections, *Acer* contains 128 extant species, most which are native to Asia. While it has been established by the fossil record that the diversification of *Acer* occurred by the late Eocene and early Oligocene epochs—roughly 32 million years ago—the explanation for this event’s timing is less apparent. The rapid global cooling event during the Eocene and Oligocene might be coincided with maple diversification, therefore facilitating the development of morphological features in *Acer* that defend against the cold. Examples of characters that contribute to cold-resistance are thick bud scales, high bud-scale counts, and the presence of trichomes. A significant gap in current literature is an examination of the relationship between *Acer* bud-morphology and the well-established phylogenetic history of maples. Our study, attempting to reconcile the already well-established phylogeny of *Acer* species with the unexplored realm of bud morphological features, endeavors to better comprehend the diversity of extant bud characteristics. Why do certain *Acer* species have higher bud scale counts? Why does trichome density similarly vary between species? And why is the thickness of bud scales also a variant trait? This research project employs established phylogenies and morphological assessment to understand the arrangement of physical characteristics in the *Acer* phylogenetic tree. We assessed the morphological traits of a representative sample of buds from sixty-three *Acer* species collected throughout Asia, Europe, and North America. After assessing *Acer* bud characters, we mapped the presence or absence of cold-resistant bud features on a known phylogeny of the *Acer* lineage to using a mapping program called Mesquite. Our preliminary results suggest that the *Acer* lineage displays an increased bud scale thickness, higher bud scale number, and an increased prevalence of trichomes, and that bud characteristics of *Acer* are strongly related to the position of the species in the phylogenetic tree. It is clear that climatic conditions have affected morphological changes and lineages with such favorable traits survive and diversify producing more species.

STREAM School and  
Standardized Testing:  
A Comparison  
of State and District-  
Level Assessments  
in Traditional versus  
Experiential Learning  
Environments

*This project was an interdisciplinary endeavor between the Department of Education and the Department of Biology. See page 104 in the education section of this book for full abstract.*

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

This abstract is not available online.

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*This material is based  
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the Sawyer Corporation*

## Genomic Analysis of the Novel Mycobacteriophage Bromden

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*This research was supported  
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Twenty new mycobacteriophages were isolated from soil samples collected around the state of Michigan and other 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. A variety of plaque morphologies were produced based on size, shape, and clarity; both lytic and temperate phages are represented in this collection. The mycobacteriophage, Bromden, was chosen as one of two phages for complete genome sequencing and comparative genomic analyses. The predominant plaque produced by Bromden after 48 hours at 32°C is 0.5 mm in diameter, circular, and clear. The genome of Bromden is 70.2 Kb, 58.2% GC, and contains 118 genes. Bromden's complete genome sequence indicates a relationship to mycobacteriophages of cluster L, and strongest similarity to mycobacteriophage DyoEdafos of subcluster L4, which is the only other member of the L4 subcluster of mycobacteriophages. The two genomes align at only 85% identity over 87% of the shorter Bromden, with the largest difference being an 8.5 kb section found in DyoEdafos but missing in Bromden. This accounts for the difference in their gene numbers, as DyoEdafos has 33 more genes than Bromden. Auto-annotation indicated there are 12 possible tRNA genes in Bromden. The GC content of Bromden (58.2%) is low compared to most other clusters of mycobacteriophages as well as their common host, *M. smegmatis* (67.4%). The other clusters with relatively low GC content also have few members, suggesting that these phages may more readily infect other bacterial hosts with lower GC content. A detailed analysis of the complete genome sequences and comparison with sequenced mycobacteriophages is the subject of the second semester of the yearlong course and is presented.

## Comparison of Executive Function in Selectively Bred Obesity-Prone and Obesity-Resistant Sprague-Dawley Rats through Behavioral Analysis

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*This project supported in part  
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Obesity has become a significant problem in the United States, with rates more than doubling since 1985 (Ng et al., 2014). While there are a variety of physical health concerns associated with obesity, current research focuses on similarities between drug addiction and obesity and has explored the effects of obesity on areas of the brain associated with motivation, reward, and higher order functions. The prefrontal cortex (PFC) controls the higher order processes, collectively described as executive functions, which include working memory, decision making, attention, and inhibitory control. Recent studies have shown that obese individuals perform more poorly on PFC mediated tasks than those considered to be of normal adiposity (Verbeken et al., 2012, Riggs et al., 2010, Reinert et al., 2013, Kamijo et al., 2013). However, little is known about the origin of these deficits, and it is critical for future treatments to gain further understanding of the role that obesity plays in the development of these deficits.

This study focused on understanding the role of obesity development on cognitive function, with the goal of understand whether obesity leads to cognitive deficits, or whether cognitive deficits lead to obesity development. In order to this, it was necessary to explore the effects of predisposition to obesity on a variety of cognitive tasks, both before and after obesity development. For this reason, selectively-bred obesity-prone and obesity-resistant Sprague Dawley rats, naturally diverge in weight when maintained on a chow diet during early adulthood (~70-75 days), were used. We hypothesized that the obesity-prone animals would exhibit differences in behavior after the development of obesity, suggesting obesity causes cognitive deficits, but not before. To test this hypothesis, a variety of behavioral tests, including Object in Place, Egocentric Morris Water Maze, and Attentional Set Shift were performed on the obesity-prone and obesity-resistant rats prior to and/or after the onset of obesity. Data suggest prior to obesity, there are no significant differences in cognitive functioning between treatments. Post-obesity behavioral analysis suggests there are trends towards cognitive deficits in the obesity prone animals, especially in the areas of the Attentional Set Shift and the Egocentric Morris Water Maze tests.

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

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This abstract is not available online.



Development of a  
qPCR Assay to  
Determine *In Situ*  
Replication of  
*Escherichia coli* in  
Freshwater  
Environments

Abstract not available in print.

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*This material is based upon work supported by the National Science Foundation under Grant No. 1616737.*

Comparing Metabolic  
Strategies of  
Environmentally-  
Isolated *Escherichia*  
*coli* Strains

This abstract is not available online.

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*This material is based upon work supported by the National Science Foundation under Grant Nos. 1330813 and 1715211*

21st Century Skill  
Development in a  
Project-Based  
Learning Program

*This project was an interdisciplinary endeavor between the Department of Education and the Department of Biology. See page 106 in the education section of this book for full abstract.*

## Monitoring Nutrient Levels and Sediment in Macatawa Watershed

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**Mallory Luke**  
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This abstract is not available online.

## Mutualism between Fly and Fungus Depends upon Fungal Reproductive Modes

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*Epichloë*, a genus of heterothallic fungi, requires two compatible partners to produce sexual spores in order for reproduction to occur. It can form fruiting bodies (stromata) on tillers of its cool season host grass causing “choke” disease. Fungi can form sexual stromata on all host tillers (type I reproductive strategy) or utilize a mixture of sexual and asexual reproduction (type II) by “choking” only some of the tillers. Stromata that have been “choked” produce spores and following fertilization produce perithecia containing ascospores. *Botanophila* flies act as a pollinating predators; in addition to vectoring spores, females also lay eggs on stromata and larvae eat perithecia. Flies were considered to be the main vectors of spores based on earlier published work, but recent data collected from Oregon and Poland suggest other mechanisms. Observations were made to determine if flies are necessary for cross fertilization of the fungus in type I and II species from Europe. Studies from field sites in Poland, France and Switzerland in 20016 and 20017 on type I and type II fungi indicate that flies are indeed not necessary for cross fertilization. The presence of slugs suggests that these may also be vectors for cross fertilization. Our data show that *Botanophila* flies are necessary vectors for individual-level type II *Epichloë* species, but not for population-level type II species, like those we studied in Europe.

*This material is based upon  
work supported by the  
National Science Foundation  
under Grant No. 1119775.*

### Isolation and Identification of Fungistatic Compounds from *Phytolacca americana* and *Phytolacca rivinoides*

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The seeds of temperate and especially tropical pioneer plants must often survive in the soil despite threats from mammalian, arthropod, and microbial seed predators. Despite these challenges, seeds of some pioneer species such as *Phytolacca americana* and *Phytolacca rivinoides* have been known to remain dormant and viable in the soil for decades. Not until a canopy gap arises overhead do surviving dormant seeds germinate. Our research seeks to identify the chemicals that may protect seeds from fungal attack while they lie dormant in the soil. To isolate possible anti-fungal components of *Phytolacca americana*, methanol seed extracts were prepared and then separated using preparative thin layer chromatography. We used poisoned-medium bioassays with pathogenic fungi on the separated fractions to further identify the compounds of interest. Once the most potent antifungal component was identified, it was purified and identified via proton nuclear magnetic resonance (<sup>1</sup>H-NMR). We determined that the most toxic fractions from both species of *Phytolacca* had <sup>1</sup>H-NMR spectra very similar to that of a previously identified compound, Isoamericanin A.

### Arrested Development—Impact of Temperature on the Isolation Frequency and Lytic Cycle Growth of Cluster K Mycobacteriophages

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Mycobacteriophages are viruses that infect mycobacterial hosts. Over 1400 mycobacteriophages are currently organized into more than 30 distinct clusters based on genetic similarity. Some cluster A and K mycobacteriophages can also infect *Mycobacterium tuberculosis*, a distinction of potential medical importance. Recently, Hope College SEA-PHAGES students have been isolating possible cluster K mycobacteriophages at a higher frequency ( $\approx 2x$ ) after lowering the isolation enrichment temperature from 37°C to 32°C. These 32°C-isolated phages were unable to propagate at 42°C. We hypothesize that the observed higher Cluster K phage isolation frequency is at least partly due to a relative growth advantage at lower temperatures that is fully compromised at 42°C. To investigate this hypothesis, we examined phage thermostability, adsorption rate, latent period, and burst size. For most tested cluster K phages isolated at 32°C, stability and host adsorption kinetics at 37°C and 42°C appeared largely unaffected. One-step growth assays were performed to determine latent period and burst size. Those results were consistent with our hypothesis: whereas 32°C-isolated cluster K phage burst size was higher and latent period comparable to our control phage at 32°C, both parameters were found compromised at 37°C. In an effort to determine the point of growth inhibition at 42°C, a temperature down-shift experiment (42°C shifted down to 32°C) was performed on Hyperbowlee, a cluster K phage isolated at 32°C and growth inhibited at 42°C. Although the 42°C temperature hold effected a smaller burst size, we found a consistent shift in time to first release of new Hyperbowlee phage, to a point 85 minutes following the temperature down-shift. These results indicate that phage infection was blocked at about 20-30 minutes into the 32°C lytic cycle. Our findings provide insight into the growth behaviors of cluster K mycobacteriophages at different temperatures that may be relevant to their population dynamics in nature.

*This research was supported by the Herbert H. and Grace A. Dow Foundation.*

Examining Deposition  
Method and Gas  
Storage Capabilities  
of HKUST-1 Metal-  
Organic Frameworks

This abstract is not available online.

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support of this research.*

## Student Learning in Online Chemistry Textbooks

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Rising textbook prices are pushing both students and professors to consider alternatives to the traditional textbook. The online medium is promising because of reduced prices and additional interactivity. One possible solution is an open textbook, which is freely available online. One feature of the online medium is that references within a textbook can be linked, and students can click these links to move easily between topics. The research performed here uses Google Analytics website traffic data to see how the over 2,000,000 visitors per month use intertext links (links to other parts of the textbook) on the 20 most popular pages. Specifically, patterns of use for intertext links were investigated and the insight gained is applied in the form of design principles for continued development of LibreText ChemPRIME textbook and other future online textbooks.

## Synthesis and Characterization of Hydrophobic Ruthenium Arene Complexes

**Carmen Chamberlain  
Vanessa Drust**

Mentor:

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*We gratefully acknowledge funding from the Hope College Department of Chemistry.*

Current platinum-based chemotherapeutic treatments show a high level of toxicity towards cancer cells. Arene-ruthenium complexes have similar properties but are less toxic to healthy cells and exhibit antimetastatic properties as well. We have synthesized several new complexes that mimic the geometry of RAPTA-C, an arene ruthenium complex known to bind to histones and have antimetastatic effects. These complexes have the general formula  $(\eta^6\text{-p-cymene})\text{RuCl}_2(\text{L})$  and  $(\eta^6\text{-2-phenylethanol})\text{RuCl}_2(\text{L})$  (where L is 4-phenyl pyridine, 4-trifluoromethyl pyridine, benzimidazole, or isoquinoline). These complexes have been characterized by  $^1\text{H}$  and  $^{13}\text{C}$  nmr spectroscopy, UV-visible spectroscopy, and ESI mass spectrometry. Interactions of these complexes with a modified ionic cyclodextrin improve their aqueous solubility and stability, and should increase their bioavailability as well.

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

**Daniel Clark**

Mentor:

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*Chemistry*

*This work was supported by the National Science Foundation under Grant Nos. 1039925, 1058981, and 1263097 and by the Schaap Research Fellows Program.*

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. 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 ( $\Delta G_{\text{hyd}}$ ), 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.

## Ethynyl-Substituted Longer Wavelength Azo Dyes for Photomechanical Applications

**Brandon C. Derstine**

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*Chemistry*

Dr. Matthew L. Smith,  
*Engineering*

This abstract is not available online.

*This work was supported by a Beckman Scholars Program award from the Arnold & Mabel Beckman Foundation, by Faculty See Grant and Undergraduate Fellowship Program grants from the Michigan Space Grant Consortium, the Henry Dreyfus Teacher-Scholar Awards Program from the Camille & Henry Dreyfus Foundation, and the Hope College Department of Chemistry's Schaap Research Fellows program.*

Sonogashira Routes to  
Phenylethynylenes  
for Photomechanical  
Polymeric Systems

This abstract is not available online.

**Addison M. Duda**

Mentors:

Dr. Jason G. Gillmore,  
*Chemistry*

Dr. Matthew L. Smith,  
*Engineering*

*This work was supported by the Henry Dreyfus Teacher-Scholar Awards Program from the Camille & Henry Dreyfus Foundation, and by the Hope College Department of Chemistry's Schaap Research Fellows program.*

Diaminoacenaphylene

This abstract is not available online.

**Patrick A. Fisher**

Mentors:

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*This material is based upon work supported by the National Science Foundation under CAREER Grant No. 0952768, by the Henry Dreyfus Teacher-Scholar Awards Program from the Camille & Henry Dreyfus Foundation, and by the Hope College Department of Chemistry's Undergraduate Research Fund and Schaap Research Fellows program.*

## Investigating the Role of xCT in Neuroregeneration

**Kevin Franz**  
**Shannon Degnan**  
**Mallory Luke**  
**Marissa Solórzano**

### Mentors:

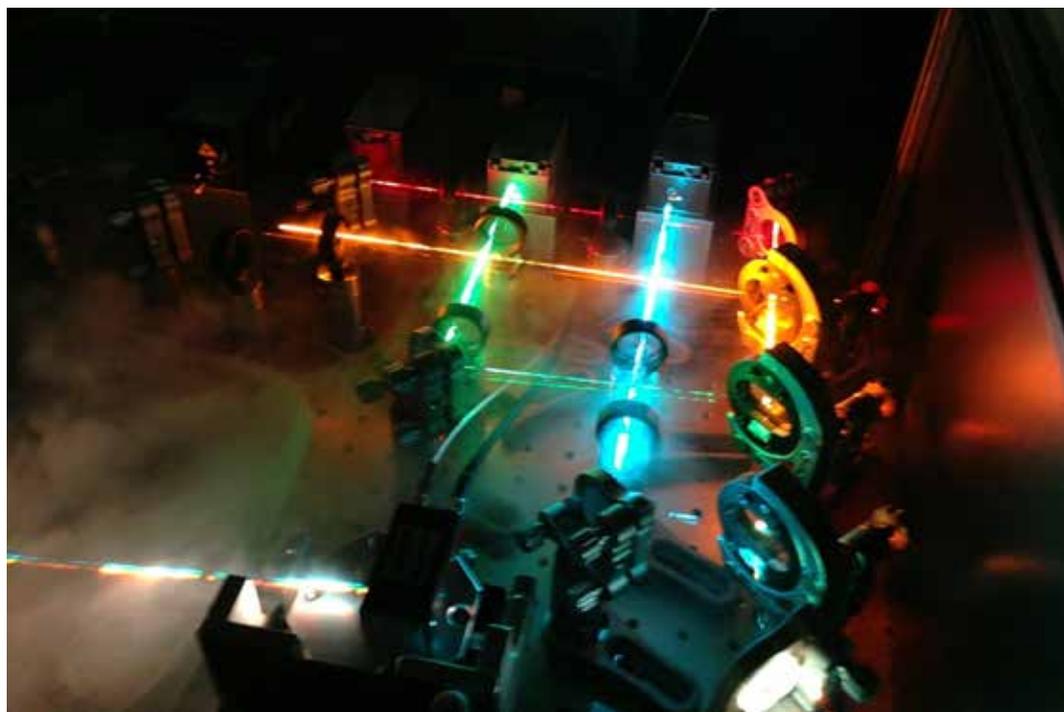
Dr. Brent Krueger,  
*Chemistry*

Dr. Leah Chase,  
*Biology, Chemistry,  
and Neuroscience*

Dr. Aaron Putzke,  
*Biology, Whitworth University*

xCT, found in neuroprotective cells like astrocytes and microglia, is an important protein in the regulation of oxidative stress within neurons and other cells<sup>1</sup>. Glutathione, a reducing agent ultimately produced from trafficking of molecules by xCT, is important in eliminating the harmful effects of reactive oxygen species<sup>2</sup>. We hypothesize that the neuroregenerative process is metabolically taxing, resulting in the formation of many reactive oxygen species, thus creating a vital need for the xCT protein. The current focus of the study is to create genetic constructs incorporating a fluorescent protein, mCherry, and an xCT-EGFP fusion protein. These proteins will be inserted into zebrafish expression vectors operating under the hb9 and GFAP promoters using subcloning. This will allow us to visualize the protein of interest during the neuroregenerative process that will be initiated using laser ablation. Results showing successful creation of the GFAP:xCT-EGFP construct are provided. Initial images from a home-built confocal fluorescence microscope are also presented, demonstrating the imaging ability of the instrument.

*This material is based upon work supported by the National Science Foundation under Grant Nos. 0843564, 1058981, 1335890, and 1263097. This research was also supported by the Schaap Research Fellows Program, the Schaap Endowed Fund for Undergraduate Research, the Herbert H. and Grace A. Dow Foundation, and the Sheldon and Marilyn Wettack Research Fellowship.*



## Regulation of System $x_c^-$ : Effects of N-terminal and C-terminal mutations on xCT cell surface expression

**Amanda Gibson**  
**Mackenzie Schmidt**  
**Philip Versluis**  
**Kevin Catalano**  
**Dylan Sabo**  
**Thomas Diaz**

Mentor:

Dr. Leah Chase,  
*Chemistry and Biology*

*Funding provided by the Hope College Departments of Biology and Chemistry and the Program in Neuroscience.*

System  $x_c^-$  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. Dysregulation of the transporter can lead to depletion of glutathione stores and the development of oxidative stress. We recently demonstrated that oxidants acutely upregulate System  $x_c^-$  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. Since increased ubiquitination tends to decrease the cell surface expression of many membrane transporters, we sought to test the hypothesis that the ubiquitination status of System  $x_c^-$  regulates its cell surface expression and activity. We have used a mutagenesis approach to disrupt a putative ubiquitin ligase binding site and putative ubiquitination sites, by mutating lysine residues to arginine, within a myc-tagged System  $x_c^-$  construct. There are seven highly conserved lysine residues within xCT that are located on the cytoplasmic side of the membrane at positions 4, 37, 41, 43, 422, 472, and 473. Using biotinylation assays and immunocytochemical analysis, we have demonstrated that mutation of the N-terminal lysine residues increases both the cell surface expression of the transporter and the rate of  $^3\text{H}$ -glutamate uptake. We are currently assessing the ubiquitination status of these mutant transporters to determine if the changes in ubiquitination are associated with changes in the cell surface expression and activity of the transporter. Our preliminary studies suggest disruption of the putative ubiquitin ligase binding site also leads to an increase in cell surface expression of the transporter. Collectively, these data suggest that System  $x_c^-$  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.

## Halogenated $\text{BF}_2$ -Azo Dyes for Incorporation in Photomechanical Systems

**Sean R. Gitter**  
**Emily K. Hofmeyer**

Mentors:

Dr. Jason G. Gillmore,  
*Chemistry*

Dr. Matthew L. Smith,  
*Engineering*

This abstract is not available online.

*This work was supported by a Faculty Seed Grant and an Undergraduate Fellowship Program Grant from the Michigan Space Grant Consortium, by the Henry Dreyfus Teacher-Scholar Awards Program from the Camille & Henry Dreyfus Foundation, and by the Hope College Department of Chemistry's Undergraduate Research Fund and Schaap Research Fellows program.*

## The Synthesis of a Highly Fluorinated EDOT Monomer for the Preparation of Hydrophobic PEDOT Coatings

**Sydney Gross**

Mentors:

Dr. Elizabeth M. Sanford,  
*Chemistry*

Dr. Kenneth L. Brown,  
*Chemistry*

*This research was supported by the Schaap Endowed Fund For Undergraduate Research.*

This abstract is not available online.

## Synthesis of Ortho-Substituted Benzamides through Nickel Mediated Cross-Coupling

**Grace C. Ahlgrim**  
**Ethan M. Heyboer**  
**Kimberly S. DeGlopper**  
**Megan R. Kwiatowski**  
**Trey C. Pankratz**  
**Mason C. Yoder**

Mentor:

Dr. Jeffrey B. Johnson,  
*Chemistry*

*This material is based upon work supported by the National Science Foundation under Grant No. 1148719 and the Schaap Fellows Program.*

Site selectivity aromatic addition with various transition metals continues to be of interest in organic chemistry. In this study, phthalimides and boronic acids with various substituents react in the presence of nickel to form ortho-substituted benzamides. Although the nickel is not yet used catalytically, the metal mediates the decarbonylative cross-coupling mechanism of the synthesis. A byproduct—the reduction product—involves a hydrogen atom taking place of the boronic acid substituent in the benzamide. The reduction product has been investigated because it makes isolation of the desired compound difficult due to similar polarity. One specific boronic acid, 2-fluorophenylboronic acid, results in a unique phenanthridine byproduct. Additional research has been carried out to investigate this byproduct.

## Heterocycle-Directed Decarbonylation of Diaryl Ketones

**Jacob Jansen**  
**Katherine Reed**  
**Gregory Campbell**

Mentor:

Dr. Jeffrey B. Johnson,  
*Chemistry*

*This material is based upon  
work supported by the  
National Science Foundation  
under Grant No. 1148719 and  
the Schaap Fellows Program.*

A mechanistic study of carbon monoxide extrusion from aryl ketones has been performed. The reaction uses a nitrogen-containing directing group to selectively cleave a carbon-carbon bond adjacent to an aryl ketone. A rhodium catalyst then removes the carbonyl and gives a coupled, biaryl product. It has been found that varying the directing group allows for probing of the relative rates of the mechanistic steps and varying the substituents on the aryl ring gives insight into the likely intermediates formed.

## Development of Rhodium-Catalyzed Carbon-Carbon Single Bond Activation via in situ Generated Imine Directing Groups

**Rebecca Johnson**  
**Meghan Campbell**  
**Erik Schoonover**

Mentor:

Dr. Jeffrey B. Johnson,  
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*This material is based upon  
work supported by the  
National Science Foundation  
under Grant No. 1148719 and  
the Schaap Fellows Program.*

Carbon-carbon bonds are ubiquitous in nature, but few methods for functionalizing these bonds exist. Previous work in the Johnson lab has demonstrated that aryl ketone carbon-carbon bonds can be activated using rhodium catalysis. However, this method of activation requires quinoline directing groups which restricts the scope of accessible ketones. To expand the utility of this methodology, the use of removable imine directing groups was explored. Initial results indicate that an alkene can undergo addition across the carbon-carbon bond of an aryl ketone, as shown below. Ketone functionality can then be restored upon hydrolysis of the imine product. The scope of ketone, amine, and alkene substrates is currently being explored.



Tetrahedrite  
Nanoparticles:  
Solution-Phase  
Synthesis and  
Thermoelectric  
Characterization

**Grace E. Kunkel**  
**Daniel P. Weller\***  
**Daniel L. Stevens**  
**Andrew M. Ochs**  
**Donald Morelli\***

*\*Department of Material  
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Mentor:

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This abstract is not available online.

*This material is based upon work supported by the National Science Foundation under Grant No. 158244, Arnold and Mabel Beckman Foundation Scholars Program, and a generous gift to Hope College from the Schaap Endowed Fund for Undergraduate Research and the Herbert H. and Grace A. Dow Foundation.*

## Leaching of Strontium Doped Hydroxyapatite Nanoparticles (nHAPs)

**Karissa Libson**  
**Anna Washburn**

Mentor:

Dr. Amanda Eckermann,  
*Chemistry*

*We gratefully acknowledge funding from the Michigan Space Grant Consortium and the Hope College Department of Chemistry.*

In ionic form, strontium has a demonstrated ability to balance the rates of bone growth and resorption. The strontium-containing drug Ranelate has been used successfully as a treatment for osteoporosis but has been associated with severe cardiovascular side effects and use is restricted. Sr-doped hydroxyapatite nanoparticles (Sr-nHAPs) offer a stable, non-toxic approach to deliver  $\text{Sr}^{2+}$  directly to bone sites. We have synthesized Sr-nHAPs with three different Ca:Sr ratios (75:25, 25:75, 0:100) and characterized them through SEM, EDS, and P-XRD. To characterize the rate at which  $\text{Sr}^{2+}$  leaches out of each of these different formulations, the Sr-nHAPs were shaken in PBS. The amount of  $\text{Sr}^{2+}$  leached into the buffer from the particles was determined using ICP-OES at 6 time points for each of these three formulations. After the first 24 hours, the rate of leaching appears to stabilize. The subject of current assessment is rate at which  $\text{Sr}^{2+}$  leaches into a blood plasma simulation buffer that contains other inorganic dications ( $\text{Mg}^{2+}$ ,  $\text{Ca}^{2+}$ ) and anions (e.g.,  $\text{HCO}_3^-$ ).

## The Preparation and Electropolymerization of an EDOT-Substituted Iron Porphyrin for Glucose Sensing

**Derrick Obiri-Yeboah**  
**Matthew Ammerman**

Mentors:

Dr. Elizabeth M. Sanford,  
*Chemistry*

Dr. Kenneth L. Brown,  
*Chemistry*

*This work was supported by the Schaap Endowed Fund for Undergraduate Research and the Department of Chemistry Endowed Funds for Undergraduate Research.*

This abstract is not available online.

Tetrahedrite  
Nanoparticles: A  
Thermoelectric  
Pathway toward  
Alternative Energy  
Applications

**Andrew M. Ochs**  
**Grace E. Kunkel**  
**Daniel P. Weller**

Mentor:

Dr. Mary Elizabeth  
Anderson,  
*Chemistry*

*This material is based upon  
work supported by the  
National Science Foundation  
Grant No. 158244.*

This abstract is not available online.

Raman Spectroscopy  
for Undergraduate  
Laboratories

**Alexander Osterbaan**

Mentor:

Dr. Justin Shorb,  
*Chemistry*

*This work was supported by  
Hellma USA, Inc.*

There are a variety of instruments that are used for quality control in industry. Each method has its own set of constraints such as long run times, extensive sample preparation, or destruction of samples. Recent advancements by MarqMetrix and Hellma, USA, have resulted in the design of the Reva Raman instrument that allows for simple, rapid, and nondestructive acquisition of Raman spectra. Raman spectroscopy can be used independently or in conjunction with other instrumental methods to analyze samples. Raman has a variety of applications such as identification, molecular feature analysis, and analytical analysis. Currently, Raman is rarely used in industry as very few people are familiar with this method. Most undergraduate chemistry major programs do not include an introduction to Raman spectroscopy throughout their four years. The objective of this project is to design labs using the Reva instrument for use at the undergraduate level.

## Synthesis and Characterization of Cobalt Schiff Base Complexes with Bioactive Ligands

**John Peterson**  
**Kathleen Muloma**

Mentor:

Dr. Amanda Eckermann,  
*Chemistry*

*We gratefully acknowledge funding from the Hope College Department of Chemistry.*

In previous work, Co(III) Schiff base (SB) complexes have been utilized in specific inhibition of transcription factors though the addition of a targeting group to the macrocyclic backbone and the ability of the complex to form bonds with histidine at its active site. Further, these complexes are attractive as redox-activated drug delivery agents due to their ability to release axial ligands upon reduction. In this work, new complexes of cobalt with biologically active ligands (L = thiazole and benzimidazole) and the SB bis(acetylacetonate)ethylenediamine (acacen) have been prepared and characterized by  $^1\text{H}$  and  $^{13}\text{C}$  NMR as well as single crystal X-ray crystallography. These complexes have the general formula  $[\text{Co}(\text{acacen})(\text{L})_2]\text{BPh}_4$  and were prepared by the reaction of four equivalents of L with cobalt bromide hydrate in methanol followed by the addition of  $\text{H}_2\text{acacen}$ . The resulting bromide salt was subjected to ion exchange with  $\text{NaBPh}_4$ . The crude solids were purified by recrystallization to yield the final complexes in reasonable yield.

## (arene) $\text{RuCl}_2(\text{L})$ Complexes as Structural Disruptors for Amyloid Beta (1-40)

**Nicholas Rozema**  
**Carmen Chamberlain**

Mentor:

Dr. Amanda Eckermann,  
*Chemistry*

*We gratefully acknowledge funding from the Hope College Department of Chemistry.*

Oligomerization of the amyloid beta ( $\text{A}\beta$ ) peptide has long been associated with neurotoxicity and subsequent neurodegeneration in the pathogenesis of Alzheimer's Disease (AD). Recent studies have illuminated the role of biologically available metal ions, specifically  $\text{Zn}^{2+}$  and  $\text{Cu}^{2+}$ , necessary for aggregation and stabilization of the neurotoxic oligomers of the  $\text{A}\beta$  peptide causing dyshomeostasis of metal ion concentrations in the brain. This research has led to the development of the "Metal Hypothesis of Alzheimer's Disease." Development of potential therapeutics, therefore, will rely on a candidate drug's ability to release trapped metal ions within aggregated  $\text{A}\beta$ , causing monomerization of the peptide and subsequent clearance by the body. Previous research has used Pt, Co, and Ru based ligands to target histidine residues within the  $\text{A}\beta$  peptide. Additionally, hydrophobic ligands have been shown to decrease the aggregation of  $\text{A}\beta$  in vitro. We have developed several (arene) $\text{RuCl}_2(\text{L})$  molecules to inhibit the oligomerization of  $\text{A}\beta$  through interference by the hydrophobic ligands (L) as well as coordination to histidine residues by the Ru center. We are currently performing aggregation assays of  $\text{A}\beta$  on the aforementioned molecules, as well as developing novel ways of testing toxicity of  $\text{A}\beta$  in the presence of these ligands in vitro.

## The Preparation of Ferrocene Functionalized Electrochemical Films for Sensor Applications

**Isaac Rusch**  
**Collin Wassilak**

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Dr. Elizabeth Sanford,  
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Dr. Kenneth Brown,  
*Chemistry*

*This research was supported  
by the Schaap Endowed Fund  
for Undergraduate Research.*

This abstract is not available online.

## The Next Generation of High Performance Computing Using Containerization

**Zachary Snoek**  
**Anna Prins**

Mentors:

Dr. Brent Krueger,  
*Chemistry*

Dr. Aaron Best,  
*Biology*

Hope College has two supercomputer clusters, curie and mu3c, that are used regularly by faculty and students throughout the sciences. Though the clusters work well overall, dealing with the dependencies inherent in an array of scientific computing software has created problems for both the users and the system administrators. To overcome these issues, we are exploring how to implement container virtualization into our clusters using Docker, an open-source container platform that provides a straightforward interface for creating and deploying containers. The knowledge gained from this project will be used to design the next generation of curie and mu3c based on containers.

Using container virtualization, we have created a test cluster and have successfully run calculations with applications such as MOPAC and R. Our research has created thorough documentation about the creation and operation of a virtualized cluster.

*This material is based upon work supported by the National Science Foundation under Grant Nos. 1039925, 1058981, and 1263097. This research was also supported by the Herbert H. and Grace A. Dow Foundation, the Schaap Research Fellows Program, and the Department of Computing and Information Technology at Hope College.*

Regulation of Cellular  
Proliferation by  
VACM-1/CUL5 is  
Dependent on its  
Posttranslational  
Modification by  
NEDD8

This abstract is not available online.

**Skylar Sundquist**  
**Si Eun Ruth Lee**  
**Nicholas Parliament**

Mentor:

Dr. Maria  
Burnatowska-Hledin,  
*Chemistry*

*This research was supported  
by the Schaap Funds and the  
Hope College Departments  
of Biology and Chemistry.*

PyScan: Interfacing  
with Laboratory  
Instruments Using  
Python

**Peter Timperman**

Mentor:

Dr. William Polik,  
*Chemistry*

Modern laboratory instruments can be interfaced with and controlled from a personal computer. Several programs to scan spectroscopic instruments and acquire data have been written by the Polik laboratory. However the existing software can only be run on Windows 98 and uses older ISA hardware. These programs must be replaced to run on modern operating systems and computers. PyScan is a laser instrument interface program intended to replace the existing software. It allows the user to control the laser, setup a scan, acquire data, and store the data for subsequent analysis. PyScan is written purely in Python 2.7 and is designed with strict adherence to the Model-Controller-View pattern. The user interface is built using Tkinter, Python's default graphic user interface library. Pyscan also makes extensive use of PySerial and Measurement Computing libraries.

Thin Film  
Synthesis and  
Characterization of  
Copper-Paddlewheel  
Surface-Anchored  
Metal Organic  
Frameworks

**Ashley Trojniak**  
**Monica L. Ohnsorg**

Mentor:

Dr. Mary Anderson,  
*Chemistry*

*This material is based upon  
work supported by the  
National Science Foundation  
under Grant Nos. 158244,  
54106, and 1126462.*

This abstract is not available online.

Validation of  
Theoretical IR  
Spectroscopic  
Methods for Protein  
Structure  
Determination

**Yong Chul Yoon**

Mentor:

Dr. Justin Shorb,  
*Chemistry*

*This research was supported  
by the Hope College  
Department of 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 do 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.

## NATURAL & APPLIED SCIENCES

### COMPUTER SCIENCE

#### Design and Development of the Hope College Student Assessment of Learning and Teaching System

**Melissa Bazany**  
**Cordell Engbers**

Mentor:

Dr. Ryan McFall,  
*Computer Science*

*This research was supported by the Hope College Assessment Committee and the Office of the Dean of Natural and Applied Sciences at Hope College.*

The Hope College Student Assessment of Learning and Teaching (SALT) system is used for the management and distribution of online course evaluations. SALT surveys allow faculty members to improve the quality of their courses through feedback and constructive criticism on their teaching effectiveness. The current system is not mobile-friendly and doesn't allow for easy customization of the content of surveys. Our summer goals were to allow professors and administrators to be able to make surveys more course and department-specific, and also to make the system more accessible on mobile devices. Results included a new user interface and device compatibility, department-specific survey templates, the option for midterm evaluation, and adding and editing custom questions. The goal is to have the system ready for use for Fall 2018 semester evaluations.

#### Pallist: Find Nearby Friends

**Grace Du Mez**  
**Michael Kiley**

Mentor:

Dr. Mike Jipping,  
*Computer Science*

This project worked with the Ready For Life Program at Hope College in order to help its students more confidently find familiar faces when they find themselves alone in a public place. Our work resulted in the construction of an iPhone app, Pallist, which allows Ready For Life students to create connections with fellow iPhone users and see which of these other users is nearby. Our app was customized for Hope College students by designing it to sense when a user is in a specific building on campus and then showing the location of fellow users that are inside this same building. When outdoors, users are considered "nearby" when they are within 50 m. of each other. Ready for Life students will be able to use our app to independently navigate new social settings with the confidence that they will be able to locate someone they know.

## Developing a Google Chrome Extension to Improve Online Readability

**Jori Gelbaugh**  
**Amber Carnahan**

Mentor:

Dr. Michael Jipping,  
*Computer Science*

The content of online articles, as well as distracting images and advertisements, can threaten a student's ability to retain critical reading information, especially a student with a reading or learning disability. Articulus is a Google Chrome extension that allows users to easily read online articles by replacing difficult words on a webpage with less difficult synonyms and by removing distracting advertisements, allowing students to easily read material at a level that is closer to their reading level. After studying readability metrics, the researchers created and extensively tested the Carnahan-Gelbaugh metric to determine the difficulty of online articles. After analyzing the difficulty of a page and determining what words are above a student's set level, Articulus passes the original word through several checks to determine the best possible synonym. The researchers studied methods for maintaining grammatical and contextual accuracy when choosing synonyms, and pass the original word through a User Synonym List, Grade Sight List, Developer Synonym List, and then finally through an external knowledge source (Collin's Thesaurus) to choose the best synonym that is appropriate in the context of the original sentence and less difficult than the original word. The researchers worked with two paraprofessionals from Black River Middle and Elementary School in Holland, Michigan, who are currently using the product to help students with disabilities understand online reading more easily; the researchers hope that future developments and improvements could expand beyond the scope of their original client to help any student struggling with online reading.

## Graph Pebbling: Doppelgangers and Lemke Graphs

**Mark Powers**

Mentors:

Dr. Charles Cusack,  
*Computer Science*  
*and Mathematics*

Dr. Airat Bekmetjev,  
*Mathematics*

Graph pebbling is a mathematical game played on a connected graph. A configuration places a nonnegative number of pebbles on each vertex. A move between a pair of adjacent vertices removes two pebbles from one vertex and places one pebble on the other. A configuration is solvable if a sequence of pebbling moves can be made to place a pebble on any given vertex. The pebbling number of a graph is the minimum number of pebbles so that any configuration is solvable. A graph satisfies the two-pebbling property if any configuration of more than twice the pebbling number minus the number of vertices with pebbles allows for placing two pebbles on any vertex after applying a sequence of pebbling moves. If a graph does not have the two-pebbling property, it is a Lemke graph. We say that two vertices are doppelgangers if they are adjacent to the same vertices. By adding vertices to a graph that are doppelgangers of existing vertices, the pebbling number does not decrease and does not increase more than the number of added vertices. By adding any number of doppelgangers to previous Lemke graphs in a particular manner, we are able to construct another graph that is also a Lemke graph. Additionally, we have created new algorithms to determine solvability. Using this along with four nondeterministic algorithms, we have been able to find all Lemke graphs with up to nine vertices.

Development of  
Model Elastomeric  
Photomechanical  
Systems and their  
Characterization

**Marcus Brinks**  
**Britta Johnson**  
**Michelle Plaver**

Mentors:

Dr. Matthew Smith,  
*Engineering*

Dr. Jason Gillmore,  
*Chemistry*

*This material is based upon  
work supported by the Hope  
College Engineering  
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Research Lab, and the  
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This abstract is not available online.

Ethynyl-Substituted  
Longer Wavelength  
Azo Dyes for  
Photomechanical  
Applications

*This project was an interdisciplinary endeavor between the Department of Chemistry and the Department of Engineering. See page 51 in the chemistry section of this book for full abstract.*

Sonogashira Routes to  
Phenylethylenes  
for Photomechanical  
Polymeric Systems

*This project was an interdisciplinary endeavor between the Department of Chemistry and the Department of Engineering. See page 52 in the chemistry section of this book for full abstract.*

Halogenated  $\text{BF}_2$ -Azo  
Dyes for Incorporation  
in Photomechanical  
Systems

*This project was an interdisciplinary endeavor between the Department of Chemistry and the Department of Engineering. See page 54 in the chemistry section of this book for full abstract.*

## Engineering the Future Academies

**Emma Jones**  
**Regan Jekkals**  
**Sara Plohetski**  
**Elizabeth Orians**  
**Kaytlyn Ihara**

Mentors:

Ms. Susan Ipri Brown  
*Engineering*

Dr. Eric L. Mann,  
*Mathematics*

*This research was supported  
by the Michigan Space  
Grant Consortium*

Opportunities for experiential learning were created for STEM teachers, pre-service teachers, and middle school students through a collaboration between the Hope College Center for Exploratory Learning (ExploreHope) and Holland Public Schools (HPS). Building on lessons learned from a three-year partnership between ExploreHope and the Muskegon Area Intermediate School District/Regional Math and Science Center, our 2017 efforts supported the growing STEM middle school programs at HPS. Designed as a learning experience for seventh grade students and a research and mentorship opportunity for undergraduate STEM education and STEM majors, the program immersed 36 middle school students in a weeklong on-campus design challenge.

## Characterizing Cortical Activation from Physical and Artificial Somatosensory Stimulation

**Anthony Nguyen**  
**Brooklyn Tobias**

Mentor

Dr. Katharine Polasek,  
*Engineering*

*This research was supported  
by the Michigan Space Grant  
Consortium, the Dean of  
Natural and Applied Sciences  
at Hope College and the  
Hope College Department  
of Engineering.*

Phantom Limb Pain occurs in the majority of people with amputated limbs, including over half of people with upper extremity amputations. This pain results from the loss of coherent input coming from the missing limb, which presumably causes changes along the somatosensory pathway. We hypothesize that by eliciting a non-painful sensation in the missing limb, phantom limb pain can be reduced or eliminated. The long-term goal of this project is to develop a therapy that consists of an electrically activated tapping sensation in the missing hand to promote neuroplasticity for recovery after neurological injury or illness.

To quantify differences in activation between artificial and actual touch, as well as to monitor changes in cortical activation over time, a method of analyzing electroencephalograms (EEG) was developed. A 32 electrode EEG cap was placed on the scalp in order to measure cortical signals. These cortical responses were investigated during a variety of stimulus conditions including: tapping on the hand, electrical stimulation, and matched-stimulation tapping. Tapping on the hand consisted of the investigator tapping on each finger and the palm. For the electrical stimulation trials, activation of the median nerve at the elbow was used to elicit a tapping sensation within the subject's hand. For the matched-stimulation trials, the investigator tapped in the location where the stimulation was felt. Source localization performed in EMSE Suite consisted of seeding six dipoles throughout the brain, with one in the somatosensory cortex, and then iterating until final dipole locations were found. EEG trials are still in progress, but preliminary trials trend towards source localization within the somatosensory cortex, with the dipoles having a high correlation ( $>0.9$ ). The expected dipole locations for each finger, starting with the thumb and moving across the hand to the little finger, are arranged medial to lateral within the somatosensory cortex. Preliminary data shows variability in final dipole locations, with some trials matching the desired order, but more trials are needed to reliably detect the localization of each finger. In the future, long-term trials will be completed to investigate and monitor changes in cortical activity over the course of the proposed therapy.

### Bio-Inspired Control of Civil Infrastructure

**Anne O'Donnell**

Mentor

Dr. Courtney Peckens,  
*Engineering*

*This project was supported by the Michigan Space Grant Consortium, the Hope College Department of Engineering, and the Christine Tempas Engineering Summer Research Fund..*

Control systems have been proposed for civil infrastructure in an effort to mitigate the damaging effects caused by external loads, such as earthquakes and high winds. Although these systems have shown great promise, they are still lacking in large-scale deployments due to challenges in the technology, including potential for computation inundation and communication latencies. To overcome these challenges, inspiration can be drawn from the simplistic mechanisms employed by the sensing and actuating processes found in the biological nervous system. A bio-inspired wireless sensor node has been developed that draws inspiration in its functionality from the mammalian cochlea, yielding it capable of real-time frequency decomposition and extreme data compression. In this study, the bio-inspired sensor node is used in a feedback control application in order to address the current limitations of control systems. Due to the up-front signal processing capabilities of the sensing node, the controller node is able to construct a control force using minimal computational resources. The bio-inspired sensing and actuating algorithm is experimentally validated on a single story shear structure. The structure's performance was studied through comparisons of the controlled and uncontrolled responses using the maximum displacement and acceleration as metrics, as well as the 1-2 norm ratio of the two quantities.

### Modeling of Different Stimulations of the Median Nerve

**Jessica Reichenbach**

Mentor

Dr. Katharine Polasek,  
*Engineering*

*This research was supported by the Michigan Space Grant Consortium, the Dean of Natural and Applied Sciences at Hope College and the Hope College Department of Engineering.*

A computer model of surface electrical stimulation was used to develop a method for activating different parts of the median nerve. The activation of different fascicles, or groups of fascicles, in the nerve may lead to sensation in smaller regions in the hand. The benefit of using a model was that different electrode shapes and stimulation values could be tested without performing hours of testing on human subjects.

There were three different electrode configurations implemented into the model. The different active electrode configurations were: a single electrode, four rectangular electrodes, and nine circular electrodes. When running simulations with the configuration made up of nine circular electrodes, it was found that different fascicles in the median nerve were activated at higher percentages depending on which electrodes were activated on the surface. This led to the use of 'field shaping' to further explore the activation of different fascicles. Field shaping was performed by using two different sets of electrodes with opposite polarity. The positive set was adjusted to a fraction of the negative stimulation voltage. Overall, this led to higher activation of axons in the targeted fascicles compared to the non-targeted fascicles.

As a next step, variation of electrode position, nerve location and internal fascicle arrangement will be tested to account for differences between individuals and to ensure reliable activation in different situations.

## Development of Wireless Sensing Unit for Environmental Noise Monitoring

**Taylor Rink**

Mentor

Dr. Courtney Peckens,  
*Engineering*

*This research was supported by the Strosaker Foundation Faculty Development Fund, part of the Nyenhuis family of funds, and Hope College Department of Engineering.*

Locations with large amounts of environmental noise can raise stress and blood pressure, as well as decrease productivity, for all peoples subjected to it. In order to better quantify these noise levels, it is important to fully understand the patterns and levels of noise through data collection and analysis. Wireless sensor networks offer one method for autonomously gathering and processing levels of noise pollution in densely populated areas. In this study, a wireless sensing unit (WSU) was developed that was capable of collecting and transmitting noise data. This WSU was comprised of a Teensy microcontroller development system, a sound detecting board, and an XBee wireless transceiver. In order to capture the auditory range that a human can hear, the WSU had to sample at 20kHz, resulting in a large accumulation of data that must be stored locally and eventually transmitted. Due to the constraints of the system, it was found that nodes would spend approximately eight times longer transmitting data than collecting data, making this not scalable for long time periods or large sensor networks. In order to limit this amount of transmitted data, on-board signal processing techniques of the noise signal were explored.

## Investigating the Kinetics of Polymerization Required for Bulk-Mediated Alignment of Liquid Crystal Elastomers

**Alyssa VanZanten**  
**Brian Simonich**

Mentor

Dr. Matthew Smith,  
*Engineering*

*This material is based upon work supported by the Dean of Natural and Applied Sciences at Hope College, the National Science Foundation under Grant No. 1649403, and the Hope College Department of Engineering.*

This abstract is not available online.

## Partial Melting of Amphibolites in the Eastern Segment of the Sveconorwegian Orogen, Southern Sweden

**Erin Brophy**  
**Max Huffman**

Mentors:

Dr. Edward Hansen,  
*Geology*

Charlotte Möller,  
*Geology, Lund University*

*Supported in part by the  
Geological Society of America.*

Migmatites form when rocks begin to melt deep in Earth's crust, then cool and recrystallize before the melt can escape. They consist of the once-melted portion of rock known as leucosome, and the consistently solid host rock, the melanosome. Mafic migmatites form from the melting of mafic rocks, such as basalt which is one of the most common rocks in Earth's crust. We examined mafic migmatites along a ~60 kilometer traverse within the Eastern Segment of the Sveconorwegian orogeny in southern Sweden. This segment consists of the eroded remains of an ancient mountain belt ~1 billion years old. This gives us an opportunity to study the metamorphic processes that occur during melting deep within the earth's crust. Along our traverse, the amount of leucosome (hence the amount of melting) varied from 0 to 25% in abundance. The minerals in the melanosome contained H<sub>2</sub>O/-OH in their structures. These features indicate that melting was triggered when water-rich fluid flowed into hot rocks lowering their melting temperature. An area further west of this traverse was studied by past Hope College students. It was observed that the temperature conditions of melting in this westerly region were much higher and melting began even in the absence of a water-rich fluid. Future work will concentrate on locating the transition between the area of fluid absent melting (observed in the western transect) with fluid-assisted melting (observed further east).

## Gegenwalle Ridges: An Ecohydrological Chronosequence in Morfa Dyffryn, Wales, United Kingdom

**Kathleen Fast**  
**Kaitlyn Caltrider**

Mentors:

Professor Suzanne  
DeVries-Zimmerman,  
*Geological and  
Environmental Science*

Dr. Brian Bodenbender,  
*Geological and  
Environmental Science*

*This research was supported  
by a Summer 2017 Nyenhuis  
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Society of America Student  
Research Grant.*

We investigated the ecohydrology of a series of gegenwalle ridges and swales at Morfa Dyffryn National Nature Reserve, Wales, United Kingdom. They form in the deflation basin of a large parabolic dune as it migrates across the landscape, creating a chronosequence. Interdunal wetlands have developed in the swales. Soil cores collected from each ridge along a transect from youngest (ridge 1) to oldest (ridge 6) perpendicular to the dune axis show the progressive development of an organic-rich horizon beginning in ridge 4. Similar development occurs in the swales beginning in slack 3.  $^{210}\text{Pb}$  and  $^{137}\text{Cs}$  soil analyses to determine the formation times of these features are ongoing. Monitoring well data show the highest water levels in the winter months during which water floods the slacks, sometimes covering the first several ridges. Slack inundation can continue into early summer. We performed vegetation sampling in 1 m<sup>2</sup> quadrats on each ridge/slack along the transect. Bare sand coverage decreases from 75% (ridge 1) to 1% (ridge 6). Ridge vegetation shows a progression from species tolerant of sand burial to those characteristic of fixed dunes. Bare sand coverage in slacks 1 and 2, 90% and 80%, respectively, sharply decreases to 50% in slack 3 due to the appearance of new species *Carex viridula* and *C. flacca* and increased abundance of existing species *Juncus articulatus* and *Agrostis stolonifera*. Additional species, including *Equisetum variegatum*, *Hydrocotyle vulgaris*, *Anagallis tenella*, and *Galium palustre*, appear in subsequent slacks with *Holcus lanatus* and *Poa pratensis* present in slack 6. Ordination using non-metric multidimensional scaling was performed for both the quadrat communities and the species. The swales show a progression from sparse vegetation to plants tolerant of periodic inundation to vegetation requiring moist conditions. Species diversity in both the ridges and slacks increases from younger ridges/slacks to older ones.



## Dune Distribution along the Laurentian Great Lakes: The Effects of Wind and Waves

**Ian Gorgenson**

Mentors

Dr. Edward Hansen,  
*Geological &  
Environmental Sciences*

Dr. Brian Yurk,  
*Geological &  
Environmental Sciences*

Professor Suzanne  
DeVries-Zimmerman  
*Geological &  
Environmental Sciences*

State and provincial databases combined with satellite images were used to classify and map dunes along the 15,700 km shoreline of the Great Lakes. Data from airport or NOAA meteorological stations were used to construct Fryberger and Dean (1979) sand drift potential diagrams for 41 coastal locations. Prevailing winds are from the southwest. However, most strong wind events are associated with extratropical cyclones. Wind directions rotate as cyclones pass through the region, often departing from the prevailing direction. High onshore drift potential occurs where onshore winds are amplified by long fetch, even along shores that do not face west. Dune complexes were divided into two basically different types. Fore-dune plain complexes (strand plain complexes) consist of parallel relict fore-dune ridges on sedimentary platforms accumulating in embayments, cusped forelands, spits, and bars. These dune ridges mark the migration of shorelines into the lakes and are scattered throughout the region, relatively independently of the orientation of shores with respect to directions of highest sand drift potential. Transgressive dune complexes migrate inland over older geomorphic surfaces and occur where the orientation of the coast is perpendicular to directions of high sand drift potential.

## Using Drone Acquired Remote Sensing to Map Sensitivity to Sand Mobility in Coastal Dunes

**Max Huffman**

Mentors

Dr. Edward Hansen,  
*Geological &  
Environmental Sciences*

Paul Pearson,  
*Mathematics*

Dune mobility can threaten human infrastructure yet is essential to maintaining ecological diversity in coastal dunes. We are developing a technique for quantifying and mapping relative tendencies for surfaces in dunes to become or remain mobile. Our basic data are 1cm<sup>2</sup>/pixel images obtained for red, green, and near-infrared spectral bands during a drone flight over a 1000 m x 400 m open dune area at Saugatuck Harbor Natural Area in southwest Michigan. The difference between the near infrared and the red intensities is sensitive to the presence of vegetation, and we used this to map the areas with little or no vegetation (bare patches). The tendency for a bare patch to develop into a migrating blowout depends on both its size and its elongation relative to the directions of sand transporting winds. We used a sliding window convolution to weigh each of these factors in mapping sensitivity to sand mobility. The orientation of the slope and the position of a patch on the slope also influence sensitivity to sand mobility. Topographical information will be collected via drone flights and these factors will be added to our analyses to create more realistic sensitivity to sand mobility, which we will then test with field observations over the next two years.

*This work was supported  
by the Michigan Space  
Grant Consortium*

## Identifying Sources of Heavy Metals in Moss Along a Mining Haul Road in NW Alaska Using Pb Isotopes and Concentrations of In and Bi

**Brooke Mattson**

Mentor

Dr. Alyssa Shiel,  
*College of Earth, Ocean,  
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Oregon State University*

*This material is based upon work supported by the National Science Foundation through Oregon State University's summer research experience for undergraduates under NSF Grant No. 1263349.*

Red Dog Mine is one of the world's largest producers of zinc (Zn) and lead (Pb) ore concentrates. The ore is hauled to their port site by truck through 32 km of northwestern Alaskan tundra within Cape Krusenstern National Monument. Elevated concentrations of Pb, Zn, and cadmium (Cd) have been documented in *Hylocomium splendens* moss samples collected along this haul road. The elevated metal concentrations have been attributed to fugitive dust lost during transport of the ore. This project builds on previous work (Neitlich et al., 2017) by using Pb isotopic signatures to evaluate sources of Pb found in the moss as a function of distance from the road. In addition, we examine the elemental ratios Zn/Pb, Zn/Cd, Pb/Cd and concentrations of ore trace constituents indium (In) and bismuth (Bi) in the moss to provide additional evidence for metal sources.

Elemental ratios in moss samples closest to the haul road exhibited ratios of Zn/Pb, Zn/Cd, Pb/Cd similar to those calculated for Zn and Pb ore concentrates produced by the mine. The trend formed by the isotopic ratios of Pb in moss samples suggests mixing between two endmember Pb compositions. The most radiogenic Pb isotopic compositions were measured in moss collected very close to the haul road and the least radiogenic in moss collected from the most southern sites, 40–60 km from the haul road. The Pb isotopic signatures of moss samples at very close distances from the haul road diverged slightly from the predicted field of ratios based upon previously published Pb isotopic compositions for Zn and Pb ores from the mine. This may be explained by the mixing of Pb and Zn ore concentrates as they are dispersed into the environment. The presence of In and Bi at elevated concentrations in samples near the road is attributed to fugitive dusts from ore transport. In contrast to the observed local natural In and Bi concentrations of about 1 ppb and 10 ppb, the samples closest to the road showed In and Bi as high as 35 ppb and 80 ppb, respectively. By combining the use of Pb isotopes with elemental analysis of In and Bi this study provides a potential method of tracing ore in the environment.

Estimating the Size  
of Very-fine Particles  
in Natural Water  
Suspensions via a  
Laboratory Settling  
Experiment

**McKenzie Stock**

Mentor

Dr. Jonathan Peterson,  
*Geological &  
Environmental Sciences*

This abstract is not available online.

Progress Update on  
Global Survey of  
Suspended Load in  
Rural Drinking Water  
Sources Using Onsite  
Water Filter Kits

This abstract is not available online.

**Cleveland Tarp**  
**Jonas Peterson**  
**Owen Donahoe**

Mentor

Dr. Jonathan Peterson,  
*Geological &  
Environmental Sciences*

Dr. Aaron Best,  
*Biology*

Dr. Michael Pikaart,  
*Chemistry*



## Identifying Sand and Vegetation in Aerial Photos of Sand Dunes via Machine Learning

**Keri Haddrill**  
**Erin Brophy**  
**Kaitlyn Caltrider**  
**Kathleen Fast**  
**Ian Gorgenson**  
**Max Huffman**

Mentors:

Dr. Paul Pearson,  
*Mathematics*

Dr. Edward Hansen,  
*Geology*

Professor Suzanne  
DeVries-Zimmerman,  
*Geology*

The Saugatuck Harbor Natural Area (SHNA) along Lake Michigan has numerous open sand dunes at risk for extinction. There, gusty winds work to reshape the dunes while vegetation tries to hold the sand in place. Thus, our project's goal is to map the changes of vegetation and sand over time. The first step in mapping SHNA is comparing the surface reflectance images collected by a drone and field biomass measurements from a few small selected areas. This information allows us to create a convolutional neural network that can approximate above-ground biomass and therefore produce a biomass map for the entirety of SHNA.

*This research was supported by the Michigan Space Grant Consortium Research Seed Grant, and Hope College Nyenhuis Faculty-Student Collaborative Research Grant.*

## Name That Bird: Using Neural Networks to Classify Recorded Bird Songs

**Russell Houpt**  
**Sarah Seckler**

Mentors:

Dr. Mark Pearson,  
*Mathematics*

Dr. Darin Stephenson,  
*Mathematics*

*This research was supported  
by Michigan Space Grant  
Consortium Research Seed  
Grant and by Hope College.*

Can a computer learn to identify a bird by analyzing samples of its song? This research explores how neural networks can be used to identify different birds from recordings of their songs. We explore convolutions, wavelets, and neural networks, how they work together, and what techniques were employed to teach the programs how to quickly and accurately identify birds. In earlier work, a research group at Hope College made progress on this question by using neural networks to classify bird songs on a somewhat limited scale. Our results extend this work by using similar techniques on larger data sets, improving the accuracy and speed of the analysis, and modifying the existing algorithms to take advantage of multiple core computers.

## Engineering the Future Academies

*This project was an interdisciplinary endeavor between the Department of Engineering and the Department of Mathematics. See page 67 in the engineering section of this book for full abstract.*

## Forecasting Disease Incidence

**Noah Kochanski**

Mentor:

Dr. Yew-Meng Koh,  
*Mathematics*

*This research was supported  
by the Michigan Space  
Grant Consortium.*

High-degree polynomials provide great flexibility and potentially perfect fit of historical time series data. Such flexibility, however, often leads to overfitting and results in models with poor predictive performance. Splines are a low-degree polynomial smoothing method which reduces these overfitting effects. We compare the performance of various models which utilise smoothing splines with regard to their forecast accuracy of Singaporean dengue fever counts.

## A Model of Reproductive Success for Neotropical Pioneer Plants

**Benjamin Pederson**

Mentors:

Dr. Brian Yurk,  
*Mathematics*

Dr. K. Greg Murray,  
*Biology*

*We would like to thank the Monteverde Cloud Forest Reserve and Tropical Science Center for allowing us access to their facilities and land.*

The tropical rainforest is a complex and diverse ecosystem, possessing many species of plants and animals. Treefall and branch breakage open gaps in the dense canopy allowing sunlight to reach the forest floor in places that were previously shaded. In these newly formed gaps, the seeds of pioneer plants that are present in the litter and soil are able to germinate.

For over 30 years, six species of pioneer plants have been studied in the Neotropical Cloud Forest in Monteverde, Costa Rica. These are measured along five 500m transects that are selected such that their topography and climate are representative of the entire forest. Building on an approach taken by Murray (1988), we created a model that estimates the total lifetime reproductive output of a single pioneer plant. To determine an estimate for the potential reproductive success of a single plant, we account for several factors contributing to the germination probability of its seeds and subsequent survival to reproductive size. Germination success is dependent upon gap age, gap size, and distance from the parent plant. Our present work extends the approach of Murray (1988) in several ways, including separately modeling seed populations within the litter layer and the soil, which exhibit different dynamics.

## Model Choice and Future Prediction Accuracy in the Time Series for Disease Incidence

**Reagan Spindler**

Mentor:

Dr. Yew-Meng Koh,  
*Mathematics*

One of the goals of time series models for disease incidence data is to predict accurately future disease counts. Many such models exist, some of which utilize information from covariates. The utility of an appropriately lagged covariate is highlighted. We introduce a Bayesian neural network time series model for predicting dengue fever incidence in Singapore, which utilizes Singaporean precipitation data as a covariate. A comparison is made between this neural network model and a time series model which does not use any covariate information. A method for choosing between the models which optimizes future prediction accuracy is suggested as well.

## A Descriptive Study on Barriers to the Use of an Online Early Childhood Education Tool for Caregivers

**Jessica Lockwood**

Mentors:

Dr. Barbara Vincensi,  
*Nursing*

Megan Koops-Fisher,  
*Ready 4 School*

Many children in the U.S. are not prepared for kindergarten with a relationship between parental involvement and kindergarten readiness seen in the research. An online program, ReadyRosie, provides Modeled Moment Videos to parents to help them engage with their children for kindergarten readiness. The purpose of this study was to determine the barriers in the use of ReadyRosie as a tool to increase caregivers' ability to preparing their three, four and five year olds for kindergarten. The nursing framework that shaped this study was Hildegard Peplau's interpersonal theory. Peplau focuses on educational and interpersonal processes which correlates with ReadyRosie's purpose. This descriptive study used phone interviews with a data collection tool developed by the researchers. The data were analyzed using SPSS and descriptive statistics. Twenty-one guardians over the age of 18 with children between the ages of 3 and 5 years were recruited from a primary care physicians' practice in the Midwest. The caregivers recruited in the office had not accepted the emailed invitation to be a part of the ReadyRosie website. The results indicated time (71.43%) was the main barrier that kept guardians from accepting the invitation for the ReadyRosie program with 9.53% reporting access to internet as the second reason. Time constraints to watching the videos in front of a computer was the major barrier identified by the participants who did not accept the emailed invitation to ReadyRosie. The limitations include possible selection bias and small sample size. The implication of this study will help understand what barriers are present to caregivers in using the ReadyRosie project to enhance kindergarten readiness.

## Parental Use of an Online Interactive Tool to Increase Children's Kindergarten Readiness

**Heather Ponstein**

Mentors:

Dr. Barbara Vincensi,  
*Nursing*

Megan Koops-Fisher,  
*Ready 4 School*

Previous studies have shown the need for parent and caregiver involvement in preparing children for kindergarten, and a need for an intervention to support and assist them in this task. The purpose of this study was to describe the effects of an online interactive educational program in preparing parents and caregivers to promote kindergarten readiness. The nursing framework used for this study was King's Interacting Systems Framework and Goal Attainment Theory, where interpersonal systems work together for mutual goal attainment. The descriptive design used a 27-item pre-post- questionnaire survey to collect data from a convenience sample (n=17). Parents and caregivers of pre-kindergarten children were recruited from a primary care physician's office in West Michigan. Data analysis was completed using SPSS and descriptive statistics. Results and conclusions show that the majority of the parents and caregivers reported the videos were very useful, while over half of the parents and caregivers felt their ability to prepare their child for kindergarten have very much or moderately improved. Limitations to this study include incomplete data, difficulty contacting participants via phone, lack of computer availability, a week where Ready Rosie website was unavailable to participants, and data collection from one site. Implications for this study are that online educational tools are potentially useful to encourage interaction of parents and caregivers with the pre-k child in preparation for kindergarten. Nurses can help promote early childhood development in their practice with the knowledge and use of an interactive educational tool like Ready Rosie with identified at-risk populations.

## Exploring the Physical Activity Behavior of Adolescent Girls: A Mixed Methods Study

**Jorgie Watson**

Mentor:

Dr. Vicki Voskuil,  
*Nursing*

*This study was supported by a Nyenhuis Faculty Development Grant for collaborative student-faculty research and through the Howard R. and Margaret E. Sluyter Faculty Development Fund.*

Despite well-established health benefits of physical activity (PA), the majority of adolescents do not meet guidelines recommending 60 minutes of moderate to vigorous physical activity (MVPA) each day. By the 9th grade, only 20% of girls report meeting recommendations for PA with lower percentages for black and Hispanic girls compared to white girls. The purpose of the study was to explore PA behavior and needs of adolescent girls. This exploratory study used a qualitative and quantitative approach. Girls in the 9th grade were recruited from a high school in West Michigan (n=11). Participants received a Fitbit activity tracker to wear for one week to measure PA. At the end of the week girls returned the Fitbit and participated in a focus group. Girls responded to open-ended questions regarding their PA behavior and shared their ideas for future intervention efforts aimed at increasing PA among adolescents. SPSS Version 22.0 and ATLAS.ti Version 8 were used to analyze data. Mean age of the girls was 15.3 years (SD=0.44). On average girls took 6,520 steps and walked 2.73 miles each day. Girls stated their favorite types of PA were walking, biking, and running. Most stated they did PA for 30 minutes or more once a day or every other day. The top 3 facilitators of PA reported by girls were friends, family, and transportation. The top 3 barriers included health issues, lack of motivation, and weather. Findings from this study indicate that PA participation for this sample is consistent with previous studies. Adolescent girls are not meeting recommended guidelines for PA. Fitbit activity trackers could be used in future interventions aimed at increasing PA for adolescent girls. PA interventions that take place in the summer with friends and include community service projects may increase PA and be well received by this population.



## Code Parallelization Using OpenMP to Offload to GPUs

**Josiah Brouwer**

Mentor:

Dr. Peter Gonthier,  
*Physics*

*This work was funded by the Hope College Department of Physics and by an undergraduate fellowship from the Michigan Space Grant Consortium.*

The population synthesis code implements Markov Chain Monte Carlo (MCMC) techniques to simulate various characteristics of radio and gamma-ray millisecond pulsars (MSPs) to test emission models. The code describes the birth features of MSPs as well as the spin-down with the age of the pulsar, provides radio and gamma-ray characteristics that are filtered through various radio surveys, and the gamma-ray threshold sky map of NASA's Fermi Gamma-ray Space Telescope Fermi to determine those MSPs that are "detected" by the simulation. The purpose of this research is to make use of graphical processing units (GPUs) to improve the efficiency of the MCMC simulation. We explore the implementation of this using the OpenMP software library built into C and C++ compilers. This will enable us to offload subsections of code to the GPU and, in this way, accelerate the execution of sections of the MCMC code. For example, GPU acceleration can be implemented in MCMC techniques that efficiently explore the free parameter space in our luminosity models. After working to configure the C++ compiler correctly, we are now able to implement GPU parallelization into the MCMC code.

## Developing the Spin Dependent Compton Scattering Cross-Section in the Strong Magnetic Fields of Magnetars

**Michael Dennis**

Mentor:

Dr. Peter Gonthier,  
*Physics*

*This work was generously funded by the Hope College Department of Physics, the Hope College Dean for Natural and Applied Sciences Office, and the Michigan Space Grant Consortium.*

Magnetars are neutron stars with extremely powerful magnetic fields that allow one to test fundamental physics inaccessible in terrestrial laboratories. In the magnetospheres of these stars accelerated electrons Compton scatter with Blackbody soft X rays from the thermal surface. This process boosts the X rays to higher energies. Using quantum electrodynamics (QED), the emission from the magnetar magnetosphere is simulated by computing the polarization and angle dependent signatures in the X ray spectra. This provides a means to disentangle geometric information, such as the magnetic inclination angle and the viewing angle of the observer relative to the rotational axis. This work will develop the general spin-dependent Compton cross-section for the transition from the ground state of the electron (positron) to an arbitrary final excited state, using refined analytics that will allow others in the astrophysics community to write efficient computer code, specifically for modeling magnetars using Monte Carlo methods.

## Calculation of Total Cyclotron Widths

**Calvin Gentry**  
**Michael Dennis**

Mentor:

Dr. Peter Gonthier,  
*Physics*

*This research was supported by the Charles & Kathy Bibart Summer Research Fund as well as the Hope College Department of Physics.*

Quantum electrodynamics as a theory is necessary in describing light-matter interactions, such as Compton scattering. In an effort to develop the theory to describe this phenomenon in strong magnetic fields, such as those present in the magnetospheres of magnetars, neutron stars with the highest magnetic fields, we are developing efficient methods to calculate total cyclotron decay widths or life times of the virtual state involved in the Compton scattering event. This involves seeking analytical expressions that are more compact and computable than previous expressions, which usually require numerical methods to calculate. The expression for total width is given in its differential form in Sina (1996) as an integral over the angular distribution of the emitted photon. Various variable changes are implemented to rephrase it as an integral over a more encompassing variable. What is now a seemingly daunting looking integral can be simplified further with implementations of series representations within the integrand. The remaining form is then a triple sum of products of various elementary functions and an associated Legendre polynomial of the second kind. With this development, we can now further improve computational efficiency by combining sums and implementing recursions.

## Determining the $\beta$ -decay Strength Function for $^{103}\text{Nb}$ and $^{104}\text{Nb}$ to Improve R-process Calculations

**Jason Gombas**

Mentor:

Dr. Paul DeYoung,  
*Physics*

*This material is based upon work supported by the National Science Foundation under Grant Nos. 1613188 and 1306074, and by the Hope College Department of Physics L.T. Guess Physics Research Fund.*

The rapid neutron capture process (r-process) predicts the formation of heavier nuclei. This process is theorized to occur in supernovas and neutron star mergers. Currently these predictions are based mostly on models of nuclei rather than experimental data. Experimenting with reactions reproducible on Earth can show if the models correctly calculate the probability of  $\beta$ -decaying to a particular excited daughter nucleus. These probabilities are known as  $\beta$ -decay intensities. The  $\beta$  decay of  $^{103}\text{Nb}$  and  $^{104}\text{Nb}$ , which are two nuclei found in the r-process, were observed at the National Superconducting Cyclotron Laboratory. Simulations were run in GEANT4 to reproduce the experimental data. The spectra from simulation were added up and their multiplicative coefficients were varied to fit the experimental data. The coefficients from the reduced chi-squared fitting determine the  $\beta$ -decay intensity function for each isotope. The experimentally determined functions will be compared to the Quasi Random Phase Approximation (QRPA) model predictions. This comparison can be used to verify the QRPA model which will lead to a more certain understanding of the nature of the nucleus. This understanding could improve the current determination of the abundance distribution for nuclei observed in the universe.

## Comparing Electrochemical Calculations and Particle Induced X-Ray Emission Measurements of Prussian Blue Analogue Deposits

**Scott D. Joffre**

Mentor:

Dr. Jennifer Hampton,  
*Physics*

Prussian Blue Analogues (PBAs) have become a popular area of study due to their low cost and ability to store charge. Producing Nickel Hexacyanoferrate (a PBA) can be time consuming and expensive. In order to reduce time and streamline the production, one can use electrochemistry to plate a PBA film onto a metallic surface. Although this provides a more efficient and faster method for production, one major disadvantage is that the amount of PBA formed by this process is not precisely known. The purpose of this research is to develop a method to compare this electrochemical process of creation with other methods which allow one to know the amount of PBA formed.

The Nickel Hexacyanoferrate (a PBA) was analyzed with Particle Induced X-ray Emission (PIXE) to determine the amount of Fe and Ni deposited. These values were then compared to the amounts determined during electrochemical production. Early measurements of the amount of PBA show that the electrochemical calculations always report a greater value than the PIXE values measured. Future work will explore possible reasons for this discrepancy.

*This work is based upon material supported by the National Science Foundation under Grant Nos. 1608327, 0959282, and 0319523.*

## Analyzing the Composition of CuInO and TiO<sub>2</sub> Semiconductor Films Using Rutherford Backscattering Spectrometry

**Zachary Kellner**

Mentors:

Dr. Stephen Remillard,  
*Physics*

Dr. Paul DeYoung,  
*Physics*

As the electronics industry continues to flourish, there is a high demand for semiconductors with novel or unexplored properties. Collaborators at Union Christian College in Aluva, India have produced CuInO thin films and TiO<sub>2</sub> nanotube films to investigate their semiconducting properties. These films are of interest due to their potential for use in solar cells. They have several properties that lend themselves to this, such as CuInO's transparency and TiO<sub>2</sub>'s use as a photoanode. These films were analysed using Rutherford Backscattering Spectrometry (RBS), a technique where a focused ion beam penetrates into a layered sample and undergoes elastic collisions with atomic nuclei in the sample. RBS allows one to determine the elemental composition at differing depths within the film. This information was checked against elemental composition data taken with Energy-Dispersive X-ray Spectroscopy (EDS/EDX). EDS provides an elemental composition but lacks any depth information. Using the elemental composition information from RBS, concentration gradients were constructed showing the changes in relative concentration of key elements in the films. This analysis also provided evidence for interface layers in the CIO samples where copper and indium had diffused from the film into the substrate.

*This work was supported by funds provided by the Hope College Dean of Natural and Applied Sciences and the Hope College Department of Physics.*

## A Novel Technique of Fluorine Detection in Soil by means of PIGE Analysis

**Brieanne Linton**

Mentor:

Dr. Paul A. DeYoung,  
*Physics*

*This material is based upon work supported by the National Science Foundation under Grant Nos. 1613188 and 1306074.*

A class of chemical compounds known as per- and polyfluoroalkyl substances (PFASs) are found present in many consumer products and are being used in fire-fighting foams during daily safety drills at airports. These fluorochemicals migrate from fire-fighting foams and consumer products in landfills contaminating the surrounding soil and groundwater. In addition to the PFASs environmental persistence, they also exhibit immunotoxicity within the human body. Ion beam analysis by means of Particle Induced Gamma-ray Emission (PIGE) spectroscopy provides a quantitative measurement of the total fluorine concentration in various samples. In order to develop a protocol for fluorine-detection in contaminated soil, standards of fluorinated soils were prepared in pellet form with varying known concentrations of Perfluorooctanoic Acid, a specific PFAS, along with varying mixtures of sand and organic topsoil. A method of separating PFAS from naturally occurring fluorine in soil is being developed in order to quantitatively measure fluorine contamination. Chemical washes are collected in Weak Anion-exchange (WAX) cartridges to determine the concentration of fluorine that has been removed successfully. Soil measured with PIGE analysis after a chemical wash yields a lower concentration of fluorine compared to the pre-washed contaminated soil.

## Automated Characterization of Fluxon Electrodynamics in a Superconducting Microwave Device

**Alexander Medema**

Mentor:

Dr. Stephen Remillard,  
*Physics*

*This material is based upon work supported by the National Science Foundation under Grant No. 1505617.*

Superconducting electronic resonators serve a wide variety of industrial and scientific applications such as MRI receiver coils and wireless transceiver filters. Characterization of fluxon electrostatics in these devices will allow for better understanding of the physical properties of superconductors and improvements to the design of cellular networking components by providing insight into how superconductors distort signals. The Hope College Microwave Group has developed a method to measure radio signal mixing in superconducting circuits during the first seconds after the removal of an applied magnetic field. Signal mixing through intermodulation distortion (IMD) is affected by the flow of supercurrent around fluxons modulated by the Meissner Effect. IMD relaxation measurements were previously limited to one measurement every five seconds, but the automated data collection developed in this project allows 15 measurements to be taken each second. The previously undetectable short-interval processes during the first second of relaxation are now being observed. This work will contribute to the understanding of fluxon dynamics in superconductors and its role in signal distortion.

## MeV Ion Beam Channeling in Strontium Titanate Crystals by Rutherford Backscattering (RBS)

**Alec Nelson**

Mentor:

Dr S. K. Remillard,  
*Physics*

*This material is based in part upon work supported by the National Science Foundation under Grant No. 1505617, the Hope College Dean for Natural and Applied Sciences, and the Hope College Department of Physics.*

Rutherford Backscattering Spectrometry (RBS) is an analytical ion beam technique used to characterise materials by backscattered particle energy and counts. In this project, the target is single crystal strontium titanate ( $\text{SrTiO}_3$ ), which forms a perovskite crystal structure. By orienting the crystal so that the 2.9 MeV  $\text{He}^+$  ion beam at the Hope Ion Beam laboratory (HIBAL) is perpendicular to the crystal plane, the particle backscattering is suppressed by enhanced penetration of the beam into the crystal. Rotational equipment was used to move through a series of tilt and azimuthal angles to create a raster scan of the crystal based on the orientation of the lattice. At the center of the raster scan is the point of maximum suppression, where the beam penetrates the farthest. Around the center of the scan in a grid-like pattern, similar points of suppression are found, likely in accordance with the perovskite structure of  $\text{LaAlO}_3$ , but are not as extreme as the center.

## Neutron Radioactivity in $^{26}\text{O}$

**Cole Persch**

Mentor:

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*Physics*

*This material is based upon work supported by the National Science Foundation under Grant No. 0969058 and the Hope College Dean for Natural and Applied Sciences.*

Currently there is only one known isotope that is likely to exhibit two-neutron radioactivity. This unique occurrence is found when observing neutron-rich  $^{26}\text{O}$ . This isotope of oxygen is particularly interesting because early experiments show it living significantly longer than nearby isotopes [1]. In order to gain a better understanding of neutron radioactivity, the MoNA Collaboration is working on determining the lifetime of  $^{26}\text{O}$ . To experimentally deduce the lifetime, the change in energy during the emission of neutrons from the  $^{26}\text{O}$  nucleus is being measured. A  $^{27}\text{F}$  beam was accelerated into a beryllium target, and a variety of interactions occurred. In the case of one-proton removal,  $^{26}\text{O}$  was formed. Two neutrons are then emitted from  $^{26}\text{O}$ , and the MoNA and LISA detectors are used to measure the velocity of the neutrons. This velocity is compared to the velocity of the fragment  $^{24}\text{O}$ . The relative velocity can be used to find the lifetime of  $^{26}\text{O}$ . Learning about this lifetime will provide valuable information about neutron-rich isotopes and give more insight into two-neutron radioactivity.

[1] Z. Kohley et al., Study of Two-Neutron Radioactivity in the Decay of  $^{26}\text{O}$  Phys. Rev. Lett. 110, 152501. Published 8 April, 2013.

## Comparison of Charge Storage Properties of Prussian Blue Analogues Containing Copper and Cobalt

**Amanda Rensmo**

Mentor:

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*This material is based upon work supported by the National Science Foundation under Grant Nos. 1608327 and 0959282.*

Prussian blue analogues (PBAs) are interesting materials of study because of their charge storing capacity. These materials can have a potential for battery technology applications if the effects of their composition and structure are understood. The focus of this study was to analyze the effects of the addition of copper or cobalt to a nickel deposition solution on the resulting PBA films. Solutions with constant metal concentration, but with different relative concentrations of NiCu and NiCo, were electrodeposited on a gold substrate through controlled potential electrolysis. In a hexacyanoferrate solution, the sample was modified in a cyclic voltammetry (CV) experiment to produce the PBA. The capacity of the modified film was characterized with CV scans using different scan rates. In addition, a scanning electron microscope with energy dispersive x-ray spectroscopy was utilized for examining the structure and composition of the film before and after the modification step. Preliminary results show that depositing the desired amount of copper was difficult whereas the cobalt depositions were more easily controlled. Yet, the deposition of copper resulted in more stored charge than that with cobalt. The amount of copper or cobalt has no effect on the kinetics or the potential of the reaction.

## First Observation of Three-Neutron Sequential Emission from $^{25}\text{O}^*$

**Caleb Sword**

Mentor:

Dr. Paul DeYoung,  
*Physics*

*This material is based upon work supported by the National Science Foundation under Grant Nos. 1306074 and 1613188.*

An active area of nuclear physics research is to evaluate models of the nuclear force by studying the structure of neutron-rich isotopes. In this experiment, a 101.3 MeV/u  $^{27}\text{Ne}$  beam from the National Superconducting Cyclotron Laboratory collided with a liquid deuterium target. The collision resulted in two-proton removal from the  $^{27}\text{Ne}$  beam which created excited  $^{25}\text{O}$  that decayed into three neutrons and a  $^{22}\text{O}$  fragment. The neutrons were detected by arrays of scintillating plastic bars, while a 4-Tesla dipole magnet placed directly after the target redirected charged fragments to a series of charged-particle detectors. From measured velocities of the neutrons and  $^{22}\text{O}$  fragments, the decay energy of  $^{25}\text{O}$  was calculated on an event-by-event basis with invariant mass spectroscopy. Using GEANT4, we simulated the decay of all nuclei that could have been created by the beam collision. By successfully fitting simulated decay processes to experimental data, we determined the decay processes present in the experiment.

## Two-Dimensional Mapping of Non-Linear Emission from Superconducting Devices

**Anna Wormmeester**

Mentor:

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*Physics*

*This material is based upon work supported by the National Science Foundation under Grant No. 1505617.*

Signal distortion from superconducting devices is caused by the nonlinearity of the superconductor, when multiple signals mix, resulting in intermodulation frequencies near that of the device's resonant frequency. The distortion products are expected to be generated at certain places in the device. Through mapping, the intermodulation hot spots can be located giving engineers a better sense of what is happening at certain parts of the superconducting device. A wide-line resonator was used to take measurements and to image the intermodulation distortion. The wide line resonator is folded into four lines, two in the middle and two on the outer edge, and all are connected through rounded edges. Multiple images were created to locate the intermodulation in the device. By refining the design of the raster probe, a better sense of where the distortion is coming from was gained. The probes that have been experimented with are a small loop probe, a small loop probe with shielding, and a magnetic circuit probe. Local variations in distortion were not detected with the magnetic circuit probe. The probe with shielding has proven most effective, exhibiting less spurious signals. The couplers that provide the input signal are also a source of spurious signal. A coupler that did not invade the device was tested. Based on the images produced, the intermodulation is localized as the probe moves across the transmission lines, and is strongest while the probe is over the transmission lines in the device.

## The Influence of Collisions in the Nonlinear Emissions of a Microplasma

**William Zywicki**

Mentor:

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*Physics*

*This material comes from work supported by the Hope College Dean of Natural and Applied Sciences and the Hope College Department of Physics.*

Nonlinearity is of interest for new device applications, such as plasma metamaterials<sup>1</sup>; however little is currently known about the nonlinearity that is created inside of the microgaps which are needed for these future technologies. The harmonic resonances of argon microplasma inside of an extreme microgap, approximately 7 $\mu\text{m}$ , have been measured. The time dependence of the breakdown has been characterized over a range of pressures, from .1 Torr to above atmospheric pressure, to observe the effect of argon-electron collisions and their emissions. A harmonic leader has been observed and charted over that range.

<sup>1</sup>Osamu Sakai and Kunihide Tachibana, "Plasmas as Metamaterials: a Review," Plasma Sources Sci. Technol. 21 (2012) 013001

## Digital Constructions of Millennial Womanhood

**Kelly Arnold**

Mentor:

Dr. Marissa Doshi,  
*Communication*

This study identifies language used by online publication Refinery29 in their content about motherhood and career. Refinery29, per their mission statement, aims to produce articles that engage smart, driven Millennial women. In our analysis, there were numerically significantly more articles published about mothering, as compared with about careers, indicating that motherhood continues to be privileged identity as well as a space for creating new scripts for motherhood. Through qualitative textual analysis and data visualization (Voyant), I found that the main themes are celebrity as role model, use of social media to share mothering stories, and earning power. For female Millennials, the plethora of motherhood and career advice available online shapes their ideas about ideal womanhood. This analysis indicates that the discourse of “new momism” is reinforced in online publications (Douglas and Michaels, 2004). Further, the lack of explicit mentions about race and class as well as the topics highlighted show implicit assumptions about the privileging of concerns of white, middle-class women. Previous researchers have worked to examine contemporary women’s magazines and identify prevalent motherhood ideologies, yet there has been little research conducted regarding these ideologies in modern online media. The significance of these themes and their presence are discussed.

Douglas, S., & Michaels, M. (2004). The new momism. In *The Mommy Myth: The Idealization of Motherhood and how It has Undermined all Women*. (pp. 1-27). New York, NY: Free Press.

## Measuring Changes in Intrinsic Religiosity among College Students

**Rachel Gillespie**

Mentor:

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*Communication*

The freshman class of 2018 cares less about religious identity than any other group of college freshmen in the last 40 years (Kavanaugh, 2015). Yet religiosity is an important piece to college student identification during undergraduate education. The transition from childhood to young adulthood is a critical period for individual self-exploration and decision-making, especially in the context of religious identification (Barry, Nelson, Davarya & Urry, 2010). Similarly, one’s undergraduate education is a period for exploration of potential futures and personal freedom (Arnett, 2000). In other words, a unique context exists to study intrinsic religiosity among young adults as they traverse their college career. While family structures and parental religiosity are important factors in young adult religiosity, the increased independence and experimentation that come with college have shown to decrease religiosity (Barry, Nelson, Davarya, & Urry, 2010). Therefore, this study surveyed college-aged students at a small, private Liberal Arts College to examine how a Christian, mission-based education may or may not influence these trends found in the literature. Specifically, this study asked if there were age and sex differences among participants reporting intrinsic religiosity and organized religious activity participation. The Duke University Religion Index (DUREL) was used to measure three dimensions of religiosity, including: organizational religious activity, non-organizational religious activity, and intrinsic religiosity (Koenig & Büssing, 2010). This study found no significant effects among participant year in school, sex, and intrinsic religiosity. Therefore, we propose a series of future research studies to continue to interrogate the unique role of a Christian liberal arts degree in young adult faith formation.

## Growing Creativity and Shrinking Traditions: An Exploration on the Internet's Impact on Gamelan in Bali, Indonesia

**Peter Rak**

Mentor:

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*Communication*

This paper explores the effects that the mass growth of the internet has had in the production and consumption of gamelan music in Bali. Gamelan is a percussive form of cultural music largely untouched by western styles of music until recently. My findings indicate that the availability of global music to which the internet gives access has led to a growth of ingenuity within newer gamelan compositions. Along with that, practice of some traditional and sacred forms of gamelan have been deteriorating as of late. The overall knowledge of region specific gamelan also decreases with the more internet access musicians have had in their lives. It appears that gamelan musicians now are less concerned with previously held boundaries and more concerned with producing ingenuitive compositions. The effects of gamelan on TV and radio are also explored, and neither of them seem to provide a substantial contribution to the Balinese gamelan scene. Additionally, Balinese citizens listen to music from outside their country more, and thus they often listen to gamelan less than they did 20 years ago. Through all these aspects, the overall attitude of Balinese people towards gamelan remains to be one of reverence, as it is regarded as a strong aspect of Balinese culture.

## College Students and Religious Identification: Perceptions and Participation in College Religious Life

**Monica Ruser  
Stephen Binnig  
Catherine MacLean**

Mentor:

Professor Lauren Hearit,  
*Communication*

Scholars have done scant research on the religious lives of American youths, despite the fact that adolescence and young adulthood are the times in life when people are most susceptible to religious influence (Petts, 2015). Typically, children have a tendency toward the religious affiliation with which their parents associate. However, young adults begin to make their parent's faith their own in adolescence or early adulthood; this time period is vital in a young adult's religious formation. Conflicting results about the effects of a religious education on a young adult's religious identification highlight an area of research that needs further interrogation (e.g., see Cook, 2015; Hastings, 1970; Kuh, 2006; Wells, 2010). A small Christian liberal arts college provided a unique context to study the religious identification of college students going through this period of religious self-identification and discovery. This study asked how voluntary campus ministry services at a small Christian liberal arts college positively or negatively impacted the faith development and identification of its students. Hill and Hood's (1999) Religiosity Scale measured four aspects of our sample's religiosity, including: the participants' degree of belief in the Divine, organizational religiosity, non-organizational religiosity, and denomination. We found mixed results: students who self-identified as more religious were less likely to participate in organized religious activities at the college we sampled. However, students reported spiritual growth over their collegiate career. This study echoes the mixed findings of the literature, and we call for more studies on the religious development of young adults within the context of a Christian liberal arts education.

## Gift of Life Michigan Research and Proposal

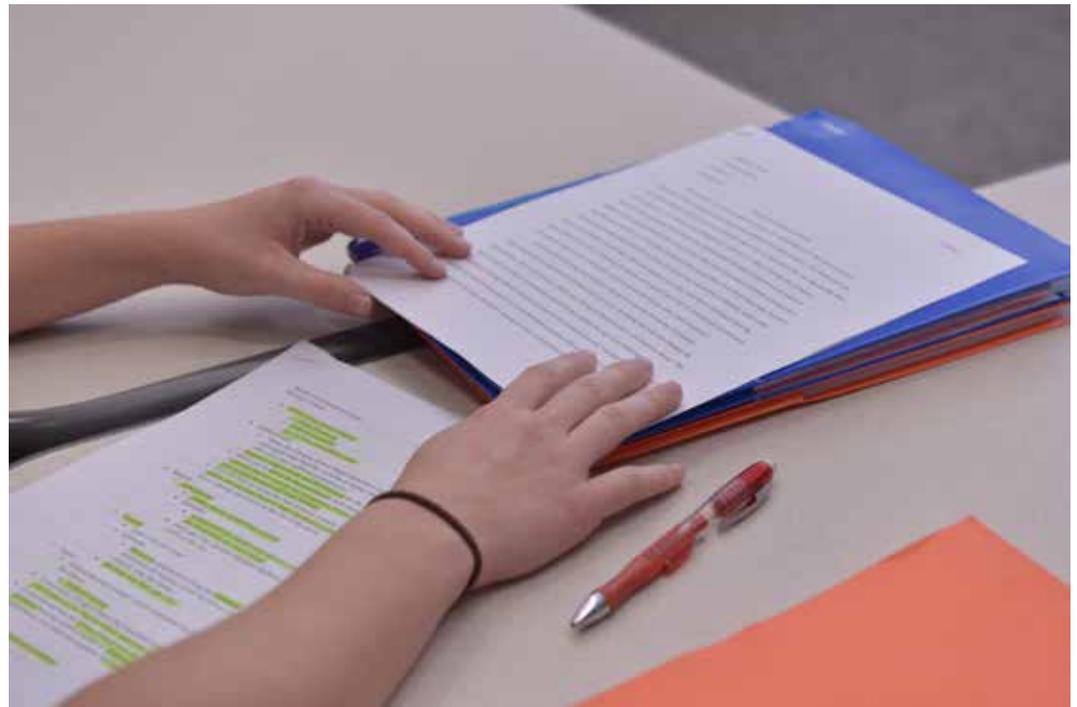
**Mendon Thomas**  
**Courtney Kuiper**  
**Tyler Windemuller**  
**Emma Chester**  
**Hailey Mulder**

Mentor:

Professor Rob Pocock,  
*Communication*

Organ and tissue donation is a topic that is not heavily discussed although it is an extremely important issue. Nearly 116,000 individuals in the United States are on a transplant waitlist indicated by national waiting list databases. Many individuals have misconceptions about being an organ donor while others simply don't know what being a donor entails. This lack of accurate information and reluctance to have conversations about organ donation has negatively affected donor registration numbers. The goal of this project was to increase awareness and encourage discussion about the topic of being an organ and tissue donor while correcting prevalent misinformation about the subject. This was achieved through three main objectives; to raise awareness via social media, to raise awareness via print sources and to encourage individuals to discuss their advanced directives with their loved ones.

Gift of Life Michigan is a non-profit organization facilitating organ and tissue donations between donors, hospitals and transplant centers across the state. All research conducted was given to Gift of Life Michigan and used to enhance their organization in hopes of extending the outreach of organ and tissue registration in Michigan. Additional information on how to register as an organ and tissue donor will be available at the poster celebration.



## Does Church Attendance Decrease Crime?

**Fernando Bahena**

Mentors:

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*Economics*

Dr. Steven McMullen,  
*Economics*

This paper builds on previous research that considers the impact of religion on crime, as there is little consensus within the existing literature on related questions. Using data on official crime reports to law enforcement provided at the county level as well as data from the Association of Religion Data Archives (ARDA), this research estimates the whether the supply of churches within an area significantly reduces crime.

## The Effects of Protective Tariffs on Employment and Wages: An Analysis of U.S. Tariffs on Chinese-Produced Tires

**Brian Brown**

Mentors:

Dr. Sarah Estelle,  
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Dr. Steven McMullen,  
*Economics*

In 2009, President Obama accepted a U.S. Trade Commission ruling of a temporary protective tariff on Chinese-produced car and light truck tires from which American firms had been facing increasing competition. Originally approved for only three years, it was reinstated in 2015 at the urging of labor unions before again being dissolved in early 2017. Much economic research questions the effectiveness of such tariffs, not just in terms of unintended consequences but also whether they actually protect domestic labor. This research estimates the effect of the tariff on employment and wages of workers in the tire manufacturing industry. The rationale behind protective tariffs is to decrease foreign competition, increasing domestic prices and allowing U.S. firms to hire more workers and/or increase wages. Alternatively, if demand for domestic tires is declining, domestic production costs are increasing, or protective tariffs have a wealth-reducing effect on U.S. consumers in general, wages and employment may fall. Data from the nationally-representative American Community Survey, including information on over 3 million households, allow this research to consider the net effect of these potential mechanisms on the tire manufacturing labor force relative to other manufacturing worker

## Does Immigration Affect Academic Achievement in U.S. Schools?

**Benjamin DeRitter**

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*Economics*

Dr. Steven McMullen,  
*Economics*

The research considers the effect of immigration on academic achievement within public schools in the United States. Immigration may have a negative impact on education outcomes because of increasing class size or expanding demand for English language learning for non-native speakers. Increasing diversity in schools, on the other hand, could have a unique benefit for native students and other immigrants. In fact, a critical mass of a particular racial or ethnic group may ease the burden on minority students, native-born or previously immigrated. This research employs nationwide data on school performance and educational outcomes, race, ethnicity, and proportion immigrant along with other control variables to obtain the net effect within a school of an increasing immigrant population.

## The Lasting Impact of Adolescent Mental Health on Educational Attainment of Adults

**Keenan Donk**

Mentors:

Dr. Sarah Estelle,  
*Economics*

Dr. Steven McMullen,  
*Economics*

Mental health complications are on the rise in the United States, and some Americans lack access to affordable, quality health care. Inspired by these trends, this research will consider the importance of mental health for educational attainment among adolescents. If adolescent mental health is a significant predictor of educational attainment, mental health services that can moderate the potential negative impact of mental health challenges on high school and college completion can have long term benefits for adult outcomes. This study uses data from the National Longitudinal Survey of Youth 1997 which surveys males and females age 12 to 17 in the initial survey year. Due to the unobserved nature of so many family-specific characteristics that can have their own impact on educational outcomes, this rich data set and a careful empirical strategy is necessary to avoid omitted variable bias. In addition to a large set of control variables, the NLSY97 includes observations of siblings within families. This research will, thereby, employ a family fixed effects approach and make causal inferences about the impact of mental health on educational attainment.

## The Effect of Economic Downturns on Marriage

**Darren Ford**

Mentor:

Dr. Steven McMullen,  
*Economics*

In times of financial distress, couples can often find themselves in difficult situations. Recessions are times in which this situation becomes relevant for families all across the United States as many will become unemployed and see a dip in income. This research aims to estimate the effect of financial strain on marriage in the United States. Consistent labor market and demographic information across time will be drawn from the Current Population Survey (CPS). The movement of the business cycle, and recurring recessions, provide exogenous variation in income and employment.

## The Convergence of Sphere Sovereignty, Local Knowledge, and Subsidiarity

**Brandon Fuller**  
**Anna Jones**  
**Alissa Frazee**

Mentor:

Dr. Sarah Estelle,  
*Economics*

Two theological traditions—sphere sovereignty and subsidiarity—and economist F. A. Hayek’s theory of local knowledge converge in significant ways, suggesting both a limited role for government and the importance of decentralized decision making. Sphere sovereignty is the belief that creation is ordered as separate spheres, each endowed with its own authority and designed for a particular purpose that should not be interfered with by any other sphere. The Catholic principle of subsidiarity requires that individuals and smaller domains are entitled to pursue their unique ends and ought to be supported but not subsumed by larger entities. Hayek’s theory of local knowledge is founded upon his assertion that knowledge is essentially dispersed throughout society. Thus, the decentralization of decision-making inherent in capitalism more fully utilizes existing, dispersed knowledge as individuals can better act upon the knowledge of “the particular circumstances of time and place.” Having explored these three principles, we conclude that—despite their divergent ideological foundations—sphere sovereignty, subsidiarity, and the theory of local knowledge comprise a practical framework suitable for crafting public policy.

## The Impact of Income and Employment on Volunteering

**John Geshay**

Mentors:

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*Economics*

Dr. Sarah Estelle,  
*Economics*

This paper investigates the effect that employment and income have on volunteer activity. While those employed may face tighter time constraints, research by the Bureau of Labor Statistics has documented that 27.2% of people that were employed volunteered, compared to only 23.3% of those unemployed. Data on time allocation, volunteering, and demographics from the American Time-Use Survey will be used to estimate the impact of labor market participation on volunteering activity.

## Raising the Standards: The Impact of Common Core Education on Intermediate Student Mathematical Achievement

**James Glagola**

Mentors:

Dr. Steven McMullen,  
*Economics*

Dr. Sarah Estelle,  
*Economics*

There has been a recent move in the U.S. toward a common curriculum, with 42 states accepting the Common Core State Standards as their new state curriculum in 2010. Instead of learning more topics at an earlier level, the new focus is to take fewer topics and go farther in depth, introducing other concepts at later stages. There has been much debate, particularly around mathematics, about whether or not this is a change for the better. This study uses NAEP scores from 2005-2015, statewide demographic data, and a difference-in-differences design to estimate the impact of common core adoption on math achievement.

## The Effect of Location on Income Inequality

**Robert Heyboer**

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*Economics*

Dr. Steven McMullen,  
*Economics*

The main goal of this project is to compare and explain income inequality based on geographic setting in the United States. The classifications for location are either inside a metropolitan statistical area which includes inside a principal city or outside a principal city, or outside of a metropolitan statistical area. Using the Current Population Survey, which is a cross-sectional study conducted by the Bureau of Labor Statistics, GINI coefficients for these areas will be used as a means of measuring inequality. This study uses regression analysis to control demographic differences and estimate the impact of geographic setting on income inequality.

## The Impact of Participation in Multiple Means-Tested Welfare Programs on Labor Supply

**Emma Nyhof**

Mentors:

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*Economics*

Dr. Sarah Estelle,  
*Economics*

The United States social safety net consists of a variety of means-tested programs, where the eligibility requirements for each often allow households the ability to simultaneously participate in multiple programs. While there has been substantial research into the effects of each individual program, less work has been done on the combined effect. This project seeks to examine how labor supply is impacted by the effective marginal tax rates resulting from multiple program participation. Specifically, this study intends to focus on the labor supply of single parent households whose income places them near ineligibility or phase-out for multiple programs. In order to estimate these effects, this study will utilize data from the Survey of Income and Program Participation.

## Swapping Guns for Books: Analyzing the Relationship between Academic Success and Violent Crime in Chicago

**Jacob Pardonnet**

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*Economics*

Dr. Steven McMullen,  
*Economics*

Existing economic research has established a negative relationship between education and crime and especially substantial effects in low-income and urban areas. This research explores the relationship between education and crime in Chicago which features the highest violent crime numbers in the country. Contemporaneous with the upswing in crime, public school enrollment in Chicago has declined and with it funding for those schools. If crime pushes families out of a city and enrollment trends influence funding levels, the crime and education relationship could be a vicious circle. This research utilizes data on violent crimes in the Uniform Crime Report and Chicago Public Schools test scores and attendance records to tease out the causal connection of education on crime.

## Is Poverty More Likely to Fall on Deaf Ears? The Effects of Being Deaf/Hard-of-Hearing on Poverty in the United States

**Alyssa Pinkham**

Mentors:

Dr. Steven McMullen,  
*Economics*

Dr. Sarah Estelle,  
*Economics*

Some previous studies have found that there is often a disparity in employment statistics and educational attainment between people with disabilities and people without disabilities. This paper examines whether being deaf or hard-of-hearing (D/HOH) increases the likelihood of being in poverty in the United States. Deafness is defined as having no hearing at all or having no functional hearing, whereas Hard-of-hearing is when a person has any level of functional hearing loss. Repeated cross-sections of data from years 2010 to 2016 of the National Health Interview Survey (NHIS) will be used to explore the relationship. The NHIS contains a wide variety of health and disability variables, as well as data on poverty, labor market outcomes, educational attainment, and demographics. This rich set of variables allows for the exploration of whether being D/HOH causes poverty because of being unemployed or not being in the labor force or because of a lower level of educational attainment or because of the degree of hearing loss. Regression analysis is used to explore these relationships and a microeconomic model is developed to represent the causal relationship between D/HOH and poverty.

## Do Teenagers Make Riskier Sexual Decisions When They Are Protected by the Hepatitis B Vaccination?

**Caroline Ritter**

Mentors:

Dr. Steven McMullen,  
*Economics*

Dr. Sarah Estelle,  
*Economics*

As teenagers grow older, they may begin to involve themselves with one another through romantic relationships and be put at risk for STD transfer via bodily fluids. This study estimates the impact of being vaccinated for Hepatitis B on the risky behaviors of youth in relationships. Better understanding these behaviors could help explain why the Center for Disease Control and Prevention is reporting that STDs are at a record high level in the United States. To determine the relationship between the Hepatitis B vaccination and risky teenage sexual behaviors, this study develops a model of choice under uncertainty and applies the model to data from the National Longitudinal Study of Adolescent Health (Add Health) using regression techniques.

## Legalization of Recreational Marijuana and its Effect on Labor Productivity

**Adam Rolain**

Mentors:

Dr. Steven McMullen,  
*Economics*

Dr. Sarah Estelle,  
*Economics*

As of 2018, eight states have legalized the recreational use of marijuana, but there has been very little research done on the impact that these changing laws have on a state economy. The current study focuses on a comparison of labor force productivity between states that have adopted recreational use of marijuana with those that have yet to do so. By comparing labor productivity statistics from the Current Population Survey, this research provides insight into the labor market effects of different drug policies. With more states voting on this issue within the coming years, it will continue to be a policy-relevant issue.

## Does Parental Involvement During Childhood Affect Substance Use

**Daniel Rush**

Mentors:

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*Economics*

Dr. Sarah Estelle,  
*Economics*

The presence and involvement of parents may have an effect on behavior and academic outcomes of their children. This study seeks to better understand the impact of parental involvement on cigarette, alcohol, and drug use in adolescents. Past studies have pointed to a positive correlation between parental involvement and a desired behavior. This study uses data from the 1997 cohort of the National Longitudinal Study of Youth data to estimate the impact child-reported parent involvement on subsequent substance abuse.

## Does Divorce Impact High School Students' GPAs?

**Samuel Schuster**

Mentors:

Dr. Steven McMullen,  
*Economics*

Dr. Sarah Estelle,  
*Economics*

In 2017, the United States of America is going to reach nearly 1,000,000 divorces and annulments for the first time in history (CDC, 2016). With divorce on the rise in the United States, it is important to understand ways to avoid negative effects on educational attainment. The High School Longitudinal Study of 2009 surveys 20,000 high school students from 944 high schools nationwide, and contains data on family, demographics and academic achievement. These data are used here to estimate the relationship between divorce and high school students' GPAs.



## Does Attention Deficit Hyperactivity Disorder Affect Prosperous Living? A Look at ADHD's Impact on Income, Employment, and Schooling

**Kurtis Slenk**

Mentors:

Dr. Steven McMullen,  
*Economics*

Dr. Sarah Estelle,  
*Economics*

This research estimates the impact of ADHD (Attention Deficit Hyperactivity Disorder) on individual income levels, employment status, and schooling. Income, employment, and education data are drawn from the National Longitudinal Survey of Youth 1979: Children and Young Adults. This study utilizes a difference-in-differences model with fixed effects to draw conclusions about the impact of ADHD income, employment, schooling, and comorbidity. This research is crucial to society, as individuals need to know the potential risks associated with ADHD.

### A Painful Problem: How is Educational Attainment Related to Opioid Overdose Rates?

**Anna Van Deelen**

Mentors:

Dr. Steven McMullen,  
*Economics*

Dr. Sarah Estelle,  
*Economics*

The opioid crisis is a national epidemic in the United States, killing an estimated 115 people every day. There is an ongoing debate on how to best deal with this public health crisis. Because of its relatively recent appearance, beginning in the late 1990s, there is very little economic literature relating to the causes of the opioid crisis. Educational attainment is well documented as having positive effects on health outcomes. Expanding on prior studies, this study explores if these educational benefits can be applied to the instance of drug abuse, especially in the case of prescription opioid pain relievers. In particular, this study uses data from the Substance Abuse and Mental Health Association and economic data from the United States Department of Agriculture to estimate the relationship between educational attainment and opioid overdose rates.

### The Effects of a Mobile Population on Green Space

**Joey Williams**

Mentors:

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*Economics*

Dr. Steve McMullen,  
*Economics*

For decades, politicians and economic theorists have asserted that free people will “vote with their feet,” migrating between localities to obtain their preferred bundle of publicly provided services and local amenities. The recent urban migration of educated young adults has played a part in the revival of former industrial cities like Detroit and, it has been hypothesized, has affected both the social and economic landscape of previously derelict regions. This research seeks to understand the impact of this migration on green space. While it is reasonable to anticipate moving to green space-prevalent areas, and thus “feet voting,” if green space is valuable to voters who have arrived for other reasons, it is also possible that green spaces and parks may expand as a byproduct of the recent migration. In other words, city planners who wish to maintain their populations will aim to reduce negative feet voting. Using the U.S. Census and data from the Detroit Blight Removal Task Force, this research estimates the relationship between growth in the educated population of an urban area and acreage of green space in a city, providing another dimension by which to understand how urban areas are shaped by their populations.

## What Produces Summer Olympic Medals? An Assessment of the Economic and Demographic Factors Determining a Country's Medal Count

**Fiona Ye**

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Dr. Sarah Estelle,  
*Economics*

This paper evaluates the factors that affect the medal count of a country obtained at the Summer Olympic Games. Data on Olympic medals comes from International Olympic Committee and country-specific economic and demographic characteristics are drawn from the World Bank. This paper uses regression analysis to estimate a production function for Olympic medals and compare the impact of an array of socioeconomic variables including: GDP per capita, literacy rate, size of population, access to electricity, and hosting advantage.

## Will Universal Basic Income Discourage Investments in Higher Education?

**Camryn Zeller**

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Universal Basic Income (UBI), a social welfare system in which all citizens of a country receive an unconditional, fixed sum of money provided by the government, has sparked the interest of many people, governments, and media platforms around the world. Although this idea has regularly circulated economic conversations since the 1960s, it has gained significant attention within the past decade as a potential solution to job loss due to technological advancement. While many focus on the perceived social benefits of UBI, few have explored the long-term effects on the value of higher education within a system that places relatively less emphasis on the purpose and importance of work. The goal of this research is to gain a broad understanding of how a UBI program will affect a student's decision to pursue higher education in the long run. This research combines rational-choice theory, empirical evidence concerning factors that influence students' education decisions, and data from past UBI experiments to anticipate the value of higher education in a future where everyone receives a universal basic income.

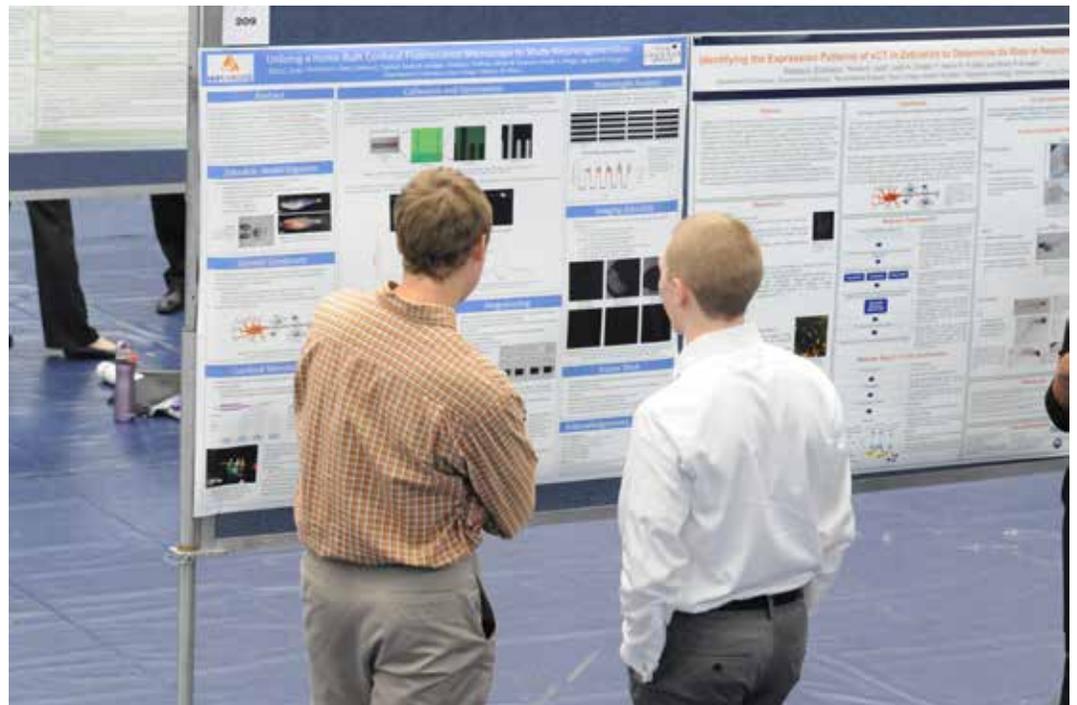
### Project Based Learning: The Teachers' Perspectives

**Shelby Bowers**  
**Montserrat Dorantes**  
**Sara Plohetski**

Mentor:

Dr. Stephen Scogin,  
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Project-based learning (PBL) is a student-centered educational experience that focuses on active learning through investigations of challenging and complex questions. PBL is showcased in a local middle school where seventh- and eighth-grade students integrate the natural world into their learning experiences. The program, called STREAM School (science, technology, reading, engineering, arts, mathematics), began in 2014. In this study, four seventh- and eighth-grade teachers from STREAM were interviewed about their opinions on the program. These interviews were transcribed verbatim and served as the primary data used in the study. Grounded theory was used to qualitatively analyze the data and determine the central theme as well as detracting and contributing factors. In analyzing these interviews, we found that the central theme affecting teachers' feelings about the program was their perspectives on the purpose of education. Teachers with the perspective that the purpose of education was to prepare students for life tended to have student-centered goals related to developing soft skills such as collaboration, problem-solving, and critical thinking. Efforts to meet these goals consisted of spending instructional time outdoors, integrating between subjects, and teaching self-management. Teachers with the perspective that the purpose of education was to prepare students for more schooling had goals oriented on meeting standards, preparing for the next grade, and performing well on standardized tests. In sum, teachers' perspectives on the purpose of education impacted their teaching methodology and subsequently affected their perceptions of student success in the program.



## Impact of Supported Residency on the Independent Living Skills of Adults with Disabilities

**Anna Davis**

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Adults with intellectual disabilities now more than ever have opportunities to live in independent communities that allows them to grow in self determinations skills. One type of a independent community is the Friendship House where individuals with intellectual disabilities live alongside of nondisabled roommates who attend Western Theological Seminary. For this study, young adults with intellectual disabilities were studied to determine if any significant increases were found in their life skills acquisitions after living in this supported community. A longitudinal study using The Transition Planning Inventory (TPI) was given to assess the individuals with disabilities independent living skills. These results conclude whether or not significant change and improvements were made in each individual's ability to perform basic life skills during the years living at the Friendship House.

## Friendship House Increases Independent Living Skills and Builds Community

**Madeline Day**

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*Education*

The purpose of this study was to measure the effects of the Friendship House, an independent living community, on building independent living skills for individuals with intellectual disabilities. This dorm is a unique setting where young adults with intellectual disabilities live alongside nondisabled peers while being involved in a university community.

A pre and post-test of the the Transition Planning Inventory (TPI) compared the self-ratings of the individuals with disabilities to their peer ratings concerning acquired independent living skills. This particular study focuses on the results of one particular resident. The TPI results were grouped into five categories: self realization, social vocational, self and family, life management, and recreation and leisure. Results showed that this individual with intellectual disability and his roommate (peer) agreed that he made significant improvement in all of the TPI categories. Overall, the Friendship House is shown to have a positive impact on improving this particular resident's independent living skills by giving him a supportive community that fosters learning and growing.

### Assessing the Impact on Learning of Summer Science Camps

**Kylie DeKryger**

Mentor:

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The Hope College Summer Science Camps were founded by Tod Gugino in 1997 to provide fun, engaging, hands-on science experiences for local K-5 students. The first summer involved 2 camps and served approximately 50 children. Over the past 20 years, the camps have expanded to the point where there are now 50 offerings, serving over 800 K-12 students during 6 weeks in the summer. In addition, 15-20 Hope College students gain experiential learning as they lead the camps and plan curriculum each summer. Recently, an effort has been made to align the science camp content with the Next Generation Science Standards. We were also interested in discovering how effective the camps are at increasing campers' STEM knowledge.

Several studies show that educational outreach programs like summer science camps increase K-12 students' interest in and positive attitudes towards STEM-related fields, such as the one conducted by Crombie, Walsh, and Trinneer [1]. However, do these increases also pair with an increase in knowledge of these subjects? Studies like the one conducted by Foster and Shiel-Rolle show that "short-term outreach activities can have a positive impact on the scientific literacy and long-term career goals of the participants" [2]. To assess levels of knowledge, most studies use a pre-test/post-test method [2,3,4] in which students take a quiz to assess their knowledge of content before the camp or activities begin and then take the same quiz at the end of the camp or activities. This is the approach that we chose to use. Across the board, the students achieved gains in knowledge. The data collected will serve as a baseline for future summer work as we continue to align the camps to standards and assess the effectiveness of the instruction.

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## Friendship House Helps People with Cognitive Disabilities Improve Their Life Skills

**Reganne Diener**  
**Dara Madai**  
**Luna Medina**

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The purpose of this study was to identify if any improvements in life skills were made for one resident with cognitive disabilities living at the Friendship House. The Friendship House is a special house where residents with special needs can have the experience of living on a university campus along with nondisabled roommates who attend the university. The roommate with a disability along with a roommate living with this individual completed the Transition Planning Inventory (TPI). When the pre and post tests were completed, the data was analyzed to discover the improvements made by the resident with a disability focusing on five categories of self-realization, social vocational, self and family, life management, and recreation and leisure. The results indicated that both this resident and her roommate noticed improvement in the categories measured by the TPI. It appears that living at the Friendship House has shown to have a positive effect on this resident's life skills and post-secondary living.

## Friendship House Research

**Carly Hampton**

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*Education and Mathematics*

The Friendship House is a unique residence hall for young adults with intellectual disabilities (called "Friends") who live alongside of nondisabled Western Seminary students. This housing provides an independent living setting for those adults with intellectual disabilities within the community of Holland, Michigan. This longitudinal study viewed the results of a pre and post test using the Transition Planning Inventory (TPI) over a five year period. These pre and post scores were based on the Friend's self score as well as the Friend's roommate. Both the self and roommate's TPI score and measured the independent living skills of the Friend in five categories: recreation and leisure, life management, self and family, social vocational, and self-realization. This poster discusses one Friend's TPI results to see if the Friendship House helps an individual with intellectual disability grow in his or her independent living skills.

## A Journey of Improvement In Word Recognition, Oral Reading, and Reading Comprehension: Does First Language Make a Difference?

**Emily Krueger**

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Do English Language Learners (ELL) grow academically at the same rate in their as non-ELL students? To investigate this research question, a study was completed that compared reading scores of ELL students to non ELL students' reading scores. All these students participated in the *Children's After School Achievement (CASA)* program for the 2016/2017 academic year. CASA is an after-school program in which college students tutor at-risk elementary students in the Holland area. In this study, all CASA students were given a pre-test in oral reading, reading comprehension, and word recognition which are subtests of the *Brigance Comprehensive Inventory of Basic Skills II (CIBS II)* in early October 2016. These same students were retested in late April of 2017 using the same *CIBS II* subtests. This research study will examine the descriptive statistics along with *t* tests, ANOVA, and MANOVA results of both ELL and non ELL students as well as other patterns that appeared in the data.

## STREAM School and Standardized Testing: A Comparison of State and District-Level Assessments in Traditional versus Experiential Learning Environments

**Chris Kruger**  
**Abby Couwenhoven**  
**Regan Jekkals**

Mentors:

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*Biology and Education*

*This research was supported by the Hope College Department of Biology.*

STREAM School is a K-12 program provided through a partnership between a public school district and a non-profit outdoor education and conservation organization in western Michigan. Although embedded in a traditional middle and high school, STREAM takes a non-traditional approach by connecting students to the outdoors through project-based learning. Standardized testing pressure sometimes discourages schools from broadly implementing non-traditional learning opportunities like STREAM. As a result, the purpose of the present study was to explore the impact of this innovative program on students' achievement on standardized mathematics tests. STREAM students in seventh through ninth-grades were compared to peers in more traditional classes using various quantitative statistical tests. Specifically, researchers investigated the following research questions: (1) Do students in STREAM progress in mathematics at the same rate as their traditional peers?; (2) Does gender have an effect on mathematics progression in either STREAM or traditional programming? Although the majority of comparisons indicated STREAM and traditional students progressed in mathematics similarly, some intriguing differences were found at certain grade levels and by gender. These findings contribute to ongoing conversations about how innovative pedagogy can be effectively integrated into existing educational systems without compromising standardized testing performance.

## Importance of Community for Improvement in Independent Living Skills for Individuals with Intellectual Disabilities

**Jessica McAlpine**

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*Education*

At the Friendship House, young adults with intellectual disabilities (called “Friends”) live alongside university students studying on campus at Western Theological Seminary. The Friendship House is apartment-style housing providing the Friends an opportunity to be a part of a community, live independently, and learn the self-determination skills. This study examined the progress made in independent living skills as rated by Friend’s self-report along with their roommates living using the Transition Planning Inventory or TPI. While this study looked at the overall improvement of all of the Friends, this poster solely focuses one Friend. The TPI included questions concerning the five areas of self-determination, social vocational, self and family, life management, and recreation and leisure. After analyzing the TPI pre and post-test scores, this particular Friend showed significant improvement in all categories. It appears that the Friendship House created a community where this Friend can improve independent living skills.

## Improvement in Independent Living Skills for a Resident with a Disability

**Amanda Miller**

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Dr. Vicki-Lynn Holmes,  
*Education and Mathematics*

Dr. Libbey Horton,  
*Education*

The purpose of this study was to identify if any improvements occurred in independent living skills among the Friendship House residents with intellectual disabilities. Friendship House is a unique setting which grants young adults with intellectual disabilities the opportunity to live on a university campus and be completely submerged in university-life. In this study, a total of six Friendship House residents and their roommates’ results were examined, but this poster focuses on the results of one of these residents. Both the Friendship House resident with a disability and his/her roommate were asked a series of questions regarding the resident’s ability to live independently using the Transition Planning Inventory or TPI. Using this assessment, a pre-test and a post-test were collected from each of these participants to get an understanding of the progress made throughout the years concerning independent living skills and to see if there are differences in perceptions between the resident with a disability and the roommate. For this research, the TPI questions were grouped into five categories: self-realization, social vocational, self and family, life management, and recreation and leisure. Results showed that both this particular resident and her roommate each felt she had improved significantly in these general areas of the TPI. Overall, the Friendship House is shown to have a positive impact on this resident in terms of improving her level of independence and transitional skills.

## 21st Century Skill Development in a Project-Based Learning Program

**Katie Rietberg**  
**Michelle Austin**  
**Cindy Alexander**

Mentor:

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*Biology and Education*

*This research was supported by the Howard R. and Margaret E. Sluyter Faculty Development Fund, part of the Nyenhuis family of funds.*

STREAM (science, technology, reading, engineering, art, and math) School is a program within a traditional middle school where students engage in outdoor, project-based learning. In this study, researchers used mixed methods to investigate the challenges and successes of the program, as well as possible changes in students' attitudes toward math, science, technology/engineering, and 21st century skills over the course of the school year. In order to interpret some of the findings, self-determination theory (SDT) was used as a conceptual framework. SDT posits that motivation is driven by feelings of autonomy, competence, and relatedness. Qualitative data were collected from student ( $n = 51$ ) and teacher ( $n = 4$ ) interviews that asked participants about their general feelings toward the program, as well as their impressions of the integrated content. The interviews were transcribed verbatim and analyzed using grounded theory, with researchers determining common themes and categories. Results of the interviews revealed student freedom and collaboration were important components of the program. Quantitative data were collected using pre-post student responses on the Students Attitudes Toward STEM Survey (S-STEM). These data were analyzed using a Wilcoxon Signed Rank Test. S-STEM results revealed a significant change in students' attitudes toward math. However, student attitudes toward all subjects were relatively high on the pre-test. Researchers concluded that giving students freedom in this type of program is important for motivation, but it also complicates effective collaboration because of off-task behavior and reduced productivity. Nevertheless, teachers were able to scaffold students' growth in these areas using various techniques that further developed students' time management skills.

## They are ALL Our Students: Inclusion in Education

**Madison Schaefer**  
**Colin Baron**  
**Cassidy Henshaw**

Mentors:

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*Education*

Dr. Jane Finn,  
*Education*

Dr. Vicki-Lynn Holmes,  
*Mathematics*

The inclusion of students with disabilities, and particularly autism, can be difficult to implement because of the team of professionals that it requires to help students succeed. The purpose of this presentation is to highlight major themes related to inclusion, provide evidence-based practices, and share testimonies from professionals of how to include students with exceptionalities in the general education setting. Mixed methods were used in the research process. Qualitative data was collected from a panel of interviews that were transcribed and coded, and a quantitative survey was sent out to Hope College education graduates. The interviewed panel was comprised of people with administrative, student, parental, or teaching backgrounds. This diversity allowed for a comprehensive perspective of inclusion. The results from this study indicate that panel members agree that the field of education has a ways to go in regards to inclusion. Additionally, the quantitative data indicates that teachers would benefit from more explicit instruction on inclusion and co-teaching. The participants viewing this presentation will (1) have a better understanding of how to include students with exceptionalities in the general education setting, (2) gain insight into how to foster positive co-teaching relationships, and (3) notice trends in qualitative and quantitative research.

## Lessons from the Past: Teaching Empathy through Historical Fiction

**Allison Utting**

Mentor:

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*Education*

*This research was supported  
by the Howard R. and  
Margaret E. Sluyter Faculty  
Development Fund, part of  
the Nyenhuis family of funds.*

Historical fiction presents an exciting pedagogical approach to teaching history. Beyond just an alternative to traditional textbook based instruction, the use of historical fiction as a source for historical inquiry has the potential to promote active student interaction with course material and nurture the development of critical thinking skills as well as a more complete understanding of history. Research conducted on historical fiction has regularly championed its ability to increase student engagement and teach historical thinking skills. Yet, despite these findings, the use of historical fiction as a pedagogical strategy remains largely unexplored in secondary history classrooms. This research project in its analysis of relevant research and through its findings from a case study explores how students respond to historical fiction as well as how historical fiction, when combined with primary sources, can be used to teach historical empathy.

## What Really Works? FBA and Classroom Management for Stu- dents with Disabilities

**Sarah Zurawski**  
**Grace Commire**  
**Emily Martin**  
**Jillian Wade**

Mentors:

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*Education*

Dr. Jane Finn,  
*Education*

Dr. Vicki-Lynn Holmes,  
*Mathematics*

This study investigated how prepared teachers felt to manage classrooms and behavior issues in the beginning of their career. We conducted a thorough literature review to examine this highly important issue. A thorough review of electronic databases (i.e. PsychInfo, Education Research Complete, ProQuest, and ERIC) was completed at the beginning of the study. This literature review provides information regarding teachers' perceptions related to classroom and behavior management. The findings highlight areas in which teacher preparation programs (i.e. colleges and universities) should provide further training. According to the research, less than 30 percent of teacher preparation programs incorporate courses on classroom and behavior management (Alvarez, 2006; Oliver, 2010). Additionally, the research indicates differences in the perceived competencies of special education teachers and general education teachers. Another aspect of this presentation will emphasize the importance of utilizing function-based interventions. The literature review indicated that the majority of teachers do not feel adequately prepared to conduct functional behavior assessments in order to effectively manage inappropriate behaviors. Currently, there is a lack of agreement on what the guidelines for conducting an FBA should be. The process is still quite individualized in educational settings (Gage, Lewis, Stichter, 2012). Researchers need to identify what should be included in FBAs, who is qualified to conduct an FBA, and the essential components of developing function-based interventions.

The participants viewing this presentation will (1) have a better understanding of the importance of FBAs and the qualifications to conduct a FBA, (2) gain insight regarding applied behavior analysis, classroom management and behavior management, and (3) notice trends in qualitative and quantitative research.

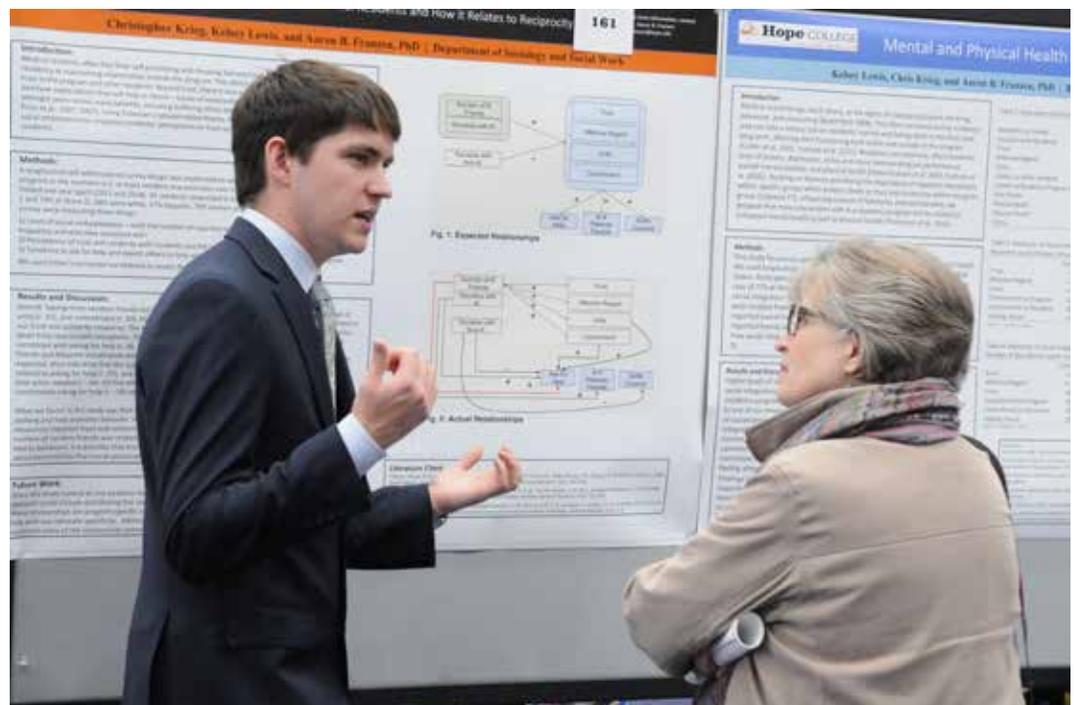
## The Effects of Foam Rolling and Static Stretching on Range of Motion and Jump Performance

**Keagan Belyk**  
**Madalyn Riedlinger**  
**Jakob Zanski**  
**Justin Fairfield**  
**Mason Rosado**

Mentor:

**Dr. Kyle Morrison,**  
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Foam rolling is a relatively new recovery modality to alleviate muscle soreness and improve athletic performance. It has been shown that bouts of acute foam rolling have significantly improved jump performance, but the effects of a chronic intervention of foam rolling compared to traditional static stretching have been researched minimally. Range of motion (ROM) has also been associated with positively benefitting from foam rolling use, which has the potential to decrease an athlete's risk of injury due to improved joint motion. Therefore, the purpose of this study is to examine the chronic effects of foam rolling and static stretching on jump performance and range of motion in Division III football players. 20 Hope College football players were recruited for this study and were subjected to a pre-test that assessed range of motion, height, weight, body fat percentage, and vertical jump (VJ) and standard broad jump performance (SBJ). The pre-tests were conducted using a standard scale, bioelectrical impedance scale, stadiometer, the Just Jump Mat by Power Systems, and a goniometer to measure range of motion. The participants were then stratified into either the foam rolling group or the static stretching group based off of their vertical jump performance. These groups were composed of an equal number of athletes. Participants in the foam rolling group completed 8 sessions of foam rolling for 15 minutes after lower strength training over a 4 week time frame. Athletes assigned to the static stretching group completed a stretching routine consisting of 5 different stretches which were held for 15 seconds each and repeated until 15 minutes of stretching was completed. The static stretching group also complete 8 sessions over a 4 week time frame. It is hypothesized that static stretching will significantly increase ROM compared to foam rolling, and that VJ and SBJ will be significantly higher in the foam rolling group. Significant results could provide Hope College athletics with greater insight on the use of foam rolling and static stretching on exercise recovery and performance. This study is ongoing and results will be presented at the Hope College Celebration of Undergraduate Research.



## The Effect of Compression Stockings on Psycho-physiological Responses in an Insufficiently Active Cohort

Summer Besteman  
Evan Augustine

Mentor:

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*Kinesiology*

*This study was supported by the Howard R. and Margaret E. Sluyter Faculty Development Fund, part of the Nyenhuis family of funds.*

There is a growing trend for runners and other active individuals to use compression stockings (CS) to improve performance. However, research examining the effect of CS on non-active individuals has yet to be done. **PURPOSE:** Therefore, the purpose of this study was to determine the effects of CS on psycho-physiological responses in an insufficiently active cohort (individuals not meeting National Guidelines for Physical Activity). **METHODS:** Ten insufficiently active individuals (22-39 yrs) volunteered for the study. The study used a randomized, crossover design with 2 conditions (with CS and without CS). Both conditions consisted of a maximal treadmill test until volitional fatigue. During the treadmill test, the incline increased 2% for every 2-minute stage, while the speed remained at 3.3mph. Recovery consisted of 5-minutes of active recovery, followed by 5 minutes of passive recovery. Seven days later, the participants repeated the maximal test but switched CS condition. Heart rate (HR), blood lactate (BLa), and rating of perceived exertion (RPE) were measured at the end of each 2-minute stage, and during minutes 1, 5, and 10 during recovery. Perceived muscle soreness was measured 24 and 48 hours post using visual analogue scales (VAS). Lactate threshold (LT) was also analyzed. **RESULTS:** Before, during, and after the maximal treadmill tests, RPE, HR, and BLa showed no significant difference between the CS conditions. However, the VAS revealed there was a significant decrease in participants perceived muscle “soreness,” “tightness,” “tenderness,” and “pulling” of their lower legs 24 hours post. **CONCLUSION:** These findings suggest that CS do not affect BLa values before, during, or after exercise. However, CS could help reduce perceived muscle soreness 24 hours following an exercise bout, resulting in decreased recovery time.

## Prevalence and Rehabilitation of Chronic Lateral Ankle Instability

Thomas Blackport

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Dr. Kirk Brumels,  
*Kinesiology*

Katharine Rose,  
*Kinesiology*

Ankle sprains are among the most common injuries experienced by athletes of all sports. With these ankle sprains, the vast majority occur on the lateral side of the ankle. In most scenarios, athletes respond well to non-operative care, using strengthening exercises to help stabilize their ankle. In the case that instability persists, surgery may be required. The focus of this case is to review the injury, surgery, and rehab of an athlete who experienced chronic ankle instability. It will review the prevalence of the injury, the anatomy affected, and the procedures used to correct the issue. Specifics of the rehabilitation process will also be covered. Outcomes will be stated and compared to what is considered the national norm. The injury consisted of general, prolonged lateral ankle instability, resulting in multiple ankle ligamentous injuries. As a result of these injuries, the decision was made to have reconstructive ankle surgery performed. The procedure performed was a Broström procedure, where the patient is put under general anesthesia and has their ligaments shortened and fastened. The rehab consisted of multiple ROM exercises to restore function, followed by strengthening and functional activities. Upon completion of the rehabilitation, full function should be attained without limitations or adverse effects.

## Examining the Validity of a Commercially Available Wrist-Worn Heart Rate Monitor

Grace Ditzenberger  
Summer Besteman  
Claire Bouret

Mentor:

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*Kinesiology*

Athletes and coaches use heart rate (HR) monitors to assess and monitor exercise intensity. Recently, there has been a move towards wrist-worn watches that use infrared technology to measure HR via the wrist. These new devices are convenient and growing in popularity, however many still need to be validated. **PURPOSE:** The purpose of this study was to determine the validity of a commercially available wrist-worn HR watch during periods of rest, exercise, and recovery. **METHODS:** Thirty division III collegiate athletes (females N=15) participated in this study. Participants were outfitted with a commercially available HR watch on their non-dominant wrist. A previously validated chest monitor served as the criterion measurement. Participants rested in a supine, seated, and standing position in 2-min stages. They then walked on a treadmill at a speed of 1mph. Every 2 min the treadmill speed was increased by 1mph. Upon reaching volitional fatigue participants completed a recovery walk at 3mph for 2 min and then rested in a seated position for final 2 min recovery stage. HR was recorded from each device every 30-seconds (4x per 2-min stage). A repeated measures analysis of variance (ANOVA) was run on all 30-second HR data to determine any significant differences in mean HR between devices at each stage. Intraclass Correlation Coefficients (ICC) analysis was run on all HR data to examine the level of agreement between devices. **RESULTS:** The ANOVA indicated significant ( $p<0.05$ ) differences between the wrist and chest monitors at 12 out of the 112 total time points (11%). An ICC of 0.78 was achieved when examining all of the 30-second data, which demonstrated a strong level of agreement between devices. **CONCLUSION:** These findings support that this commercially available watch is as valid as the traditional chest strap monitor for continuous measurement of HR.

## The Correlation between Balance and Performance in Collegiate Swimmers

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Jennifer Leichty  
Gabrielle Spanger  
Viviana Giesen

Mentor:

Dr. Maureen Dunn,  
*Kinesiology*

Balance has been shown to enhance athletic performance in certain sports. However, research regarding balance and swim performance is limited, and the relationship is therefore unclear. This study was designed to determine whether a relationship exists between balance ability and swim performance of male and female Hope College swimmers ( $n=23$ ). It was hypothesized that greater balance ability in swimmers would be positively correlated with faster swim times, which could be a benefit to swim-training programs in the future. A balance plate and Y-Balance test (Upper and Lower Quarter) were utilized to assess swimmer balance. The following static force plate stances were used: feet parallel with eyes open (FPEO), feet parallel with eyes closed (FPEC), left foot forward tandem with eyes open (LTEO), and left foot tandem with eyes closed (LTEC). The race times used for correlational analysis included: the 50m Freestyle, 100m Freestyle, 500m Freestyle, and 100m Backstroke. Significant correlations were found between FPEO velocity and the 50m Freestyle ( $p<0.01$ ,  $R=0.845$ ), 100m Freestyle ( $p<0.01$ ,  $R=0.762$ ), and 500m Freestyle ( $p=0.025$ ,  $R=0.708$ ). However, there were no significant results between race times and FPEO area. Significant results were also found between right arm dynamic balance scores and the 100m Freestyle ( $p=0.012$ ,  $R=-0.557$ ), 500m Freestyle ( $p=0.016$ ,  $R=-0.750$ ), and 100m Back ( $p=0.039$ ,  $R=-0.653$ ). Additionally, left arm dynamic balance scores were significant for the 100m Freestyle ( $p=0.012$ ,  $R=-0.561$ ) and 500m Freestyle ( $p=0.022$ ,  $R=-0.719$ ). Lastly, there were no significant results found between lower limb dynamic balance scores and race times. While further research is necessary to determine cause and effect, moderate evidence was found to support the relationship between balance and performance in collegiate swimmers.

## Prognosis, Treatment, Recovery, and Future for a Collegiate Male with a Spinal Cord Injury: A Case Study

**Bryanna Howard**

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Some injuries that we see in athletic populations are not strictly orthopedic. This is the case for a 19-year-old male who had plans to play lacrosse in college. The summer before his freshman year, a construction accident left him with a spinal cord injury that paralyzed him from the waist down. This case study will not go from surgery to rehabilitation to return to play. Instead there will be an analysis of the injury and the mechanisms used to repair and stabilize the spinal cord. A discussion of the on-going psychological recovery of the injury and the changed outlook on life will be focused on. Now, about two years post-injury, future goals and self-projections by this individual will be reviewed from a medical perspective and from his perspective. Many pathologies seen in athletic populations are not this severe, but nonetheless every athlete needs to be addressed from all aspects of a person. The physical injury should be addressed, but the psychological aspect of the injury cannot be absent from the recovery process.

## Testing the Validity of the Apple Health Application through Assessment of Step Count

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Mentor:

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With the rise in popularity of fitness trackers amongst the general population, it is important to assess the validity of various products on the market. The iPhone Health application was released in 2013 and comes preloaded on every iPhone. The increased demand for iPhones and the lack of research on Apple's Health application presents the need for the current study. The aim of this study is to assess the validity of the Apple Health application by comparing step count during one week of free-living activity to the previously validated Omron HJ-720 pedometer as well as comparing step count in a controlled lab setting on a treadmill at varying speeds to the pedometer and manual step counting. It was hypothesized that the Apple Health application would be more of a valid tool for counting steps in a controlled lab setting versus a free-living setting. Twenty Hope College students ( $n=20$ ) were recruited to participate in the present study. After 5 weeks of data collection, a significant intraclass correlation was discovered between the manual counter and pedometer at 3.5 mph for the hand ( $ICC = .882, p = <.001$ ) and pocket stages ( $ICC = .864, p = <.001$ ) and 2.5 mph for the backpack stage ( $ICC = .761, p = <.001$ ). There was no significant correlation between the iPhone and manual counter for any of the treadmill test conditions. Significant intraclass correlations were found between the pedometer and iPhone during days two ( $ICC = .898, p = <.001$ ), four ( $ICC = .829, p = <.001$ ), five ( $ICC = .839, p = <.001$ ), six ( $ICC = .959, p = <.001$ ), and seven ( $ICC = .815, p = <.001$ ) of the free living condition. The results suggest the lack of validity of the iPhone in assessing step count for exercise specific activities and suggests the potential usefulness of the iPhone in assessing step count in general daily activities.

## The Effect of Sodium Phosphate on Peak Power Output in Male Cyclists

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**Matthew Karlovich**  
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Mentor:

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Sodium phosphate is a supplement shown to have an ergogenic effect during exercise. It has been reported to increase levels of 2,3 diphosphoglycerate, assist with cellular buffering, and increase phosphate levels which are a key component of the body's phosphagen system. Most prior research has only examined the benefits of this supplement during aerobic exercise. The purpose of this study was to investigate the effect that sodium phosphate supplementation had on repeated anaerobic performance via peak and mean power output during maximal cycling. Nine trained cyclists ( $43 \pm 12.14$  years) from the Holland area were recruited for this study. Participants underwent five visits to the Hope College Exercise Physiology Laboratory. These visits included a familiarization day, and two days each of pre and post-supplementation testing. During this double blind crossover study participants took a pre-test, and then ingested either sodium phosphate (50mg/kg lean body mass) or placebo four times daily for six days. Each then undertook a post-test, had a two-week washout period, and then repeated the procedure with the alternate treatment. Prior to each visit, participants were asked to abstain from caffeine ingestion for 12 hours, and mimic physical activity and diet for 24 hours. Participants warmed up on a cycle ergometer for as long as necessary before performing six 15-second maximal cycle sprints separated by two minutes of active recovery. Heart rate was recorded before and after each sprint, and peak and mean power were measured during each sprint. It was hypothesized that sodium phosphate supplementation would lead to a significant increase in peak and mean power output compared to the placebo. Significant results would allow sodium phosphate supplementation to be recommended to cyclists trying to increase power output. This study is ongoing and results will be available upon completion.

## Bilateral Pars Interarticularis Fracture Repair at L3 in a Male Collegiate Lacrosse Player: A Case Study

**Laura Ramaker**

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Back pain can be caused by many different pathologies. This case examines the diagnosis, treatment, and rehabilitation of bilateral pars interarticularis fractures, or spondylolysis, of an 18 year old collegiate men's lacrosse athlete. He reported to the college athletic training room originally seeking treatment for hip flexor and low back tightness and was referred for chiropractic care of his back. There was no significant mechanism of injury reported with the onset of symptoms in his low back. After several weeks of continued pain, the patient was referred to a primary care physician for evaluation. After radiographic films and referral to an orthopedic surgeon, bilateral stress fractures were identified at the L3 level. Initial treatment was conservative with limitation of activity and use of a lumbar restrictive back brace. After several months and minimal improvement, treatment became surgical. The technique used was a Buck's repair, where the fracture was repaired with use of screws to hold the pars interarticularis together bilaterally. Post-surgery rehabilitation included 12 weeks of immobilization in a lumbar brace. At 12 weeks, rehabilitation exercises were initiated focusing on gaining core stability and strength. From core stability, exercises shifted to functional exercises, and gradual participation in lacrosse practice, with clearance for full activity at six months post surgery. While this case was repaired with a Buck's technique, other surgical techniques will be explored. Other factors explored in this case study include correlations between spondylolysis cases and lacrosse players, success and failure rates of conservative treatment of spondylolysis, and potential indicators to differentiate this injury from other back injuries.

## Acute Effects of Wearing the Elevation Training Mask at Different Settings on Time to Fatigue, Rating of Perceived Exertion, Peak Blood Lactate and Heart Rate During a Cycle Ergometer Submax Test

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The Elevation Training Mask (ETM) was originally produced to simulate altitude through airflow restriction. However, current research has proven that it does not provide the same benefits as training at high altitudes. Still, many athletes, professional and amateur, use them as a training tool. This study aims to examine the effect of an ETM on workout session quality measured by time to exhaustion, blood lactate, heart rate and rate of perceived exertion. The goal of this study is to determine if using an ETM will allow the user to achieve the same exhaustive effects of a training session in less time. Furthermore, the researchers will be examining the optimal level of air restriction (altitude setting) required to achieve the desired training effect. Ten subjects will participate in a five week testing protocol which includes a VO<sub>2</sub> max test to assess peak wattage, followed by a cycle ergometer test at 85% of their peak wattage with the ETM set at zero airflow resistance (baseline), and then three tests wearing the ETM at randomized elevation settings (3K, 6K, 9K). Heart rate, and RPE will be assessed during each testing phase, and blood lactate will be assessed after the baseline and randomized setting tests. We hypothesize that when wearing the ETM; max heart rate and peak blood lactate levels will remain constant, however time to fatigue will decrease and rate of perceived exertion will increase as the resistance of the mask is increased. Significant results would allow ETM to be either recommended or discouraged as a training tool at certain resistance settings. This study is ongoing, and results will be available during the poster celebration.

## The Effect of Acute Post-Exercise Sauna Bathing on Aerobic Performance in Untrained College Females

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Summer Besteman  
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Mentor:

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**BACKGROUND:** Sauna bathing post exercise is a method employed by athletes to improve aerobic performance. Previous research has determined that using a sauna for 30 minutes following exercise can decrease resting heart rate and resting blood pressure, while increasing total blood and plasma volume. An increase in plasma volume allows for more oxygen delivery to the working muscles, which may positively impact athletic performance. Little research has been conducted using post exercise sauna bathing in bouts less than 30 minutes or in an untrained population. Therefore, the purpose of this study is to examine the impact of 10-minute post-exercise sauna bathing sessions on aerobic performance in untrained females. **METHODS:** Participants completed a submaximal treadmill protocol to determine aerobic fitness. Participants walked at 3.5mph and every three minutes the treadmill incline increased by 2%. Heart rate was recorded every minute until participants reached 85% of their maximum heart rate. After being randomly assigned to the sauna or the control group, participants engaged in 15-minutes of High Intensity Interval Training (HIIT) on Mondays and Fridays (Run 30 seconds, Recovery Walk 1 minute) over the course of two weeks. Following HIIT the control group rested for 10 minutes at room temperature, while the experimental group rested in the sauna. A second submaximal treadmill test was performed at the completion of the three weeks. It was hypothesized that the sauna group would experience a greater increase in aerobic performance compared to the control group. Significant findings could indicate that exercise plus sauna bathing leads to greater aerobic improvement over exercise alone. The results of this ongoing study will be available at the 2018 Celebration of Undergraduate Research.

## Posterior Cruciate Ligament and Posterolateral Corner Reconstruction in a Collegiate Football Player: A Case Study

**Madison Roskuszka**

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While the anterior cruciate ligament (ACL) continues to be a predominant knee injury sustained in athletics its counterpart, the posterior cruciate ligament (PCL), is rarely at the forefront of the sports medicine world and because of this perhaps not widely understood. This case surrounds a collegiate football player that sustained a non-contact injury resulting in a posterior cruciate ligament tear along with disruption of the posterolateral corner. The patient underwent a six hour surgery to reconstruct the PCL as well as the posterolateral corner using three separate allografts. The purpose of this research project is to look at case studies in which the subject sustained a PCL injury. Certified athletic trainers are likely to come into contact with this injury and should be equipped to educate the athlete on the injury as well as carry out an effective treatment and rehabilitation protocol. This research is focused on the occurrence rates for PCL strains, the mechanisms of injury, common treatments and rehabilitation as well as the link between PCL injuries and degenerative joint disease in the medial aspect of the knee.

## The Effects of Implementing a Plyometric Box Jump Program on Lower Body Power in Collegiate Athletes

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**Patrick Patton**  
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Strength programs commonly rely on traditional strength training, but the development of new training modalities such as plyometrics has manifested an entire new way of increasing power. The purpose of this study was to compare the effects of a five week plyometric box jump progression program to a five week traditional bodyweight exercise program on lower body power in collegiate athletes. The study measured the improvements for the plyometric group and control group (N=24) in lower body power through vertical jump, and broad jump using Just Jump Mat and standardized testing procedures. The subjects consisted of Hope College Softball and Lacrosse athletes. The plyometric group (N=11) utilized a progressive box jump program and the control group (N=13) utilized a body weight progression for five weeks performing the exercise three days a week for three sets of six repetitions (3x6). A pretest was conducted prior to the five weeks and a post test was conducted after the program. Following the exercise program, the results displayed no significant difference in improvement in vertical jump ( $F(1, 22)=0.405$ ,  $p=0.531$ ) between the control group (pre:  $0.509 \pm 0.089m$ , post:  $0.513 \pm 0.099m$ ) and plyometric group (pre:  $0.484 \pm 0.056m$ , post:  $0.498 \pm 0.069m$ ). The results also displayed no significant difference in improvement in broad jump ( $F(1,22)=2.126$ ,  $p=0.159$ ) between the control group (pre:  $1.88 \pm 0.29m$ , post:  $1.94 \pm 0.32m$ ) and plyometric group (pre:  $1.86 \pm 0.20m$ , post:  $1.97 \pm 0.25m$ ). Although there was no statistical significance, the trend of improvement in the plyometric group implied a practical significance that could be utilized by coaches, athletes, and trainers to strengthen existing exercise programs that improve lower body power.

## Feasibility of Using the Polar A370 to Monitor a Division III Women's Soccer Season

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*This research was supported by Faculty/Student Collaborative Frost Research Center Grant.*

**BACKGROUND:** Many athletes and sport teams rely on wearable technology to assist with their training, performance, and recovery. Often, this technology is expensive, cumbersome, and not feasible for everyone to purchase. Polar makes an affordable, wrist-worn activity tracker that could be a viable option for athletes to use for training. Thus the purpose of this study was to determine the feasibility of using a Polar A370 tracker to assess training-related variables during a Division III Women's Soccer competitive season. **METHODS:** 18 females (age  $20.1 \pm 0.83$ yr, height  $167.4 \pm 6.7$ cm, weight  $65.9 \pm 7.7$ kg) from the Hope College women's soccer team participated in this study. During preseason, each participant was outfitted with a Polar A370 watch. They were instructed to wear the watch during each practice throughout the season. The watch recorded HR data, total distance traveled (miles), and calories expended (kcal). Mean data was analyzed via repeated measures analysis of variance across three season timepoints: first half (A), midpoint (B), and final half of the season (C). **RESULTS:** There were no significant ( $p < 0.05$ ) changes in HR across the three time points. Total distance traveled during practice was significantly lower ( $p < 0.05$ ) at time point C (3.6miles) compared to A (4.8miles) and B (4.3miles). Calories expended were also significantly lower ( $p < 0.05$ ) during time point C (486.6kcal) compared to A (687.6kcal) and B(658.1kcal). **CONCLUSION:** The Polar A370 appears to be a feasible tool for assessing training during a competitive soccer season. Data indicate that during the course of the season volume of training decreased while intensity remained consistent.

## The Chronic Effects of Moderate Intensity Yoga Training versus Moderate Intensity Aerobic Exercise on Self-Esteem in College-Aged Females

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It is well-established that exercise of various forms has positive effects on mental health. These effects include increases in cognitive function, improvements in mood, and decreases in anxiety. Previous studies have shown that yoga training significantly improves self-esteem for individuals across various age groups, but little research has focused on the effects of yoga training on college-aged women compared to aerobic exercise training. The purpose of the study was to compare the chronic effects of 4 weeks of moderate intensity yoga training, moderate intensity aerobic exercise, or no physical activity (control group), on self-esteem in college-aged females exercising 3 days weekly for 40 minutes per session. Twenty-six participants will take the Rosenberg self-esteem survey before and after the four-week exercise intervention to compare the effects of yoga, aerobic activity and no exercise on self-esteem. Participants will be eligible based on self-esteem scores as well as other factors affecting self-esteem (i.e. GPA, perceived socioeconomic status), and will then be matched into one of the three groups consisting of ten participants per training group (yoga or aerobic exercise) and six participants in the control group. All exercise sessions will be supervised and will take place in either the Dow Center or DeVos Fieldhouse. It was hypothesized that the participants in the yoga training group will show greater increases in self-esteem than the aerobic exercise or control group. Significant results would provide female college-aged students with an effective exercise intervention contributing to self-esteem improvement. This study is ongoing, and the results will be available upon completion.

## Acute Rhabdomyolysis in a Collegiate College Football Athlete

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Katharine Rose,  
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A 19-year-old male collegiate football athlete was playing in a full contact game on a hot Saturday in the Fall of 2017. The athlete was engaged in an aggressive hit during the second to final drive, and reported with symptoms after the game. The Athletic Trainer evaluated his symptoms at the time, which appeared to be associated with a head concussion. That evening, patient's symptoms from the initial diagnosis had increased, so he was referred from the Hope Athletic Training Facility to the Holland Hospital Emergency Department. After blood work was done, the patient showed exceedingly high levels of Creatine Kinase, which concludes the patient was experiencing Exertional Rhabdomyolysis, along with excessive dehydration. Exertional Rhabdomyolysis is a condition that can occur when the athlete over expands on the athletic field, causing the body to resort to alternative and secondary stores of energy in the body, which can lead to liver and kidney failure. Exertional Rhabdomyolysis is a condition that may occur among collegiate athletes, and can be life threatening if not identified. Athletic fields where this is most commonly seen is CrossFit athletes and other high exertional anaerobic activity. Athletic Trainers are educated to recognize its onset of symptoms, attempting to eliminate the injury or reduce its negative impact on the athlete. Many external contributing factors can lead to rhabdomyolysis symptoms, and those will be examined and have discussion in ways that medical providers can attempt to aid their athletes by eliminating these factors.

## The Effect of SmartCellsUSA Mat on Absorbing Impact Forces Using Various Weighted Objects

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**BACKGROUND:** Certain activities (e.g. jumping and falling) can inflict significant forces onto the human body, that in turn can result in impact-related injuries. SmartCellsUSA manufactures a mat designed to reduce these impact forces. They claim their mat is capable of reducing ground reaction forces on the body by up to 90%, which could theoretically minimize the risk of impact-related injuries. However, the veracity of these claims is currently unclear. Thus, the purpose of this study was to examine the level of force reduction via the SmartCellsUSA mat. **METHODS:** A LoadVUE force plate was used to measure ground reaction forces. A range of weights (2-12lbs) were dropped onto the force plate both with (experimental) and without (control) the mat. Weights were dropped twenty times in succession from a predetermined height for both conditions. Force readings were then averaged together and the difference between the two surfaces was compared. The percent difference was calculated using Microsoft Excel. Significant mean differences were calculated using a two-tailed paired t-test. **RESULTS:** In all instances the mat significantly ( $p < 0.05$ ) reduced the impact of the weight. The greatest significant force reduction was 63.2% (2 lb weight at 30 inches above force plate) while the smallest was 23.1% (10 lbs at 9 inches above force plate on concrete). **CONCLUSION:** This study supports claims made by SmartCellsUSA that their mat reduces impact forces. However, it appears that the claim of a 90% reduction is overstated. Future research should investigate the mat's force-reduction capabilities using human participants to better gauge the mat's practical utility.

## Effect of Acute Ingestion of a Cup of Coffee on 5-Km Running Performance in Collegiate Cross-Country Athletes

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**Sarah Spencer**  
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Previous research has shown that various forms of caffeine can enhance exercise performance in many activities. However, the vast majority of prior studies have examined effects of caffeine in pill form, rather than from a cup of coffee. Specifically, the effect of a low dosage of caffeinated coffee on 5-km running performance has not yet been studied in depth. Therefore, the purpose of this study was to determine the effect of ingestion of twelve ounces of caffeinated coffee on 5-km performance in Hope College male and female cross-country runners. Ten participants were brought in for a familiarization trial, which included taking baseline measurements and a 2-km timed treadmill run after drinking twelve ounces of water. Following familiarization, participants were divided into two groups matched for best 5-km time, and a double-blind crossover design was used. All participants abstained from caffeine for at least 12 hours before each trial. One group consumed 12 oz of caffeinated coffee before the 5-km treadmill time trial the first week, while the other group consumed 12 oz of decaffeinated coffee before the trial. The following week, the groups consumed the alternate treatment. At the completion of each kilometer, time, HR, and RPE were recorded. Trials occurred seven days apart on the same day of the week, at the same time of day, and diet and physical activity were mimicked before each trail. It was hypothesized that the 5-km completion time after caffeinated coffee consumption would be significantly faster than when decaffeinated coffee was consumed. Significant results would allow for the recommendation of caffeinated coffee consumption before cross-country races for college-aged runners. This study is ongoing, and results will be available during the poster presentation.

## Recurrent Anterior Cruciate Ligament Tears in a Male Collegiate Football Player

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he likelihood of recurrent tears in the Anterior Cruciate Ligament in the same knee will be investigated. In addition, graft use, surgical method, and prevalence of recurrent tears along with medial meniscus injuries will also be considered. The rehabilitation process is also an important aspect that should be considered when investigating the connection of re-tear and meniscus injuries. Through research as well as a specific case study, the prevalence and likelihood of this injury taking place will be determined. The case is as follows: A Hope College male collegiate football player has suffered recurrent tears of the Anterior Cruciate Ligament of his right knee in the past three football seasons. The first incident with this athlete involved a non-contact isolated ACL tear. The 2nd time he tore the ligament, contact was involved and the medial meniscus was also compromised.

## The Comparison of Roller Massagers and Foam Rollers on Hamstring Flexibility in Female Collegiate Basketball Players

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Mentor:

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Roller massagers (RM) and foam rollers (FR) have previously been reported to increase flexibility and range of motion (ROM) in diverse populations. The goal of this study was to compare the effectiveness of the FR and RM on hamstring flexibility and hip ROM. Fifteen healthy Hope College female basketball players participated in three counterbalanced treatment sessions that included RM, FR, and control (CON). The intervention for each treatment lasted a total of 10 minutes, with a five minute cycle ergometer warm up and a total of four minutes of rolling. Following each treatment, flexibility was assessed using a sit and reach test, and ROM was assessed with goniometer measurements. The researchers hypothesized that the FR would increase flexibility and ROM more effectively than the RM. It was also hypothesized that both the FR and RM would have a greater effect on flexibility and ROM when compared to the control. After three weeks of acute treatment sessions, the researchers found that the RM had a greater effect on the sit and reach than the FR, but neither treatment was different from control (FR:  $36.91 \pm 1.84$  cm, RM:  $39.81 \pm 1.52$  cm, CON:  $37.99 \pm 1.74$  cm,  $p=0.032$ ). Additionally, the FR tended to have a greater effect than the RM on hip flexion in the left leg (FR:  $117.78 \pm 2.28$  degrees, RM:  $115.84 \pm 2.30$  degrees, CON:  $112.29 \pm 2.66$  degrees,  $p=0.067$ ), where  $FR > CON$ , but FR was not different from RM. There was no significant difference between treatments for hip extension in either leg ( $p < 0.05$ ). This is one of the first studies to investigate the comparison of the RM and FR. It was demonstrated that the RM appeared to have a greater impact on hamstring flexibility, while the FR had a greater effect on hip ROM. Further study is necessary to determine if one tool is more effective than the other.

## The Effect of Kinesiotape on Grip Strength, Muscular Fatigue, and Blood Lactate Levels in Hope College Athletes

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**BACKGROUND:** Kinesiotape (KT) has been used by athletes for rehabilitation and performance since its invention in 1979. KT provides support and stability to joints and muscles. As such, many athletes use it on their lower limbs to assist with running. However, its effect on upper limb strength and fatigue is unknown. Therefore, the purpose of this study is to investigate the effects of KT on maximal grip strength and muscular fatigue in Hope College Athletes. **METHODS:** College athletes were randomized into one of two conditions: experimental (KT applied to the forearm) a control (no KT). Participants' strength was obtained via a maximal grip strength test using a Jamar Hand Dynamometer. Fatigue was assessed via a repeated contraction test. Participants squeezed the dynamometer for 2 seconds and then relax their grip for 2 seconds. They repeated this pattern until they reached volitional fatigue. This fatigue test was repeated three times with 3 minutes recovery between each test. Blood lactate via finger stick was measured following the final fatigue test on each day. All testing was then repeated 24 hours later. One week later, participants switched conditions and performed two additional days of testing. We hypothesize that KT will significantly increase maximal grip strength and resistance to muscular fatigue, while decreasing post-testing blood lactate levels. Significant results would help clarify KT's influence on muscle strength and fatigue while additionally providing evidence to support KT's specific physiological effects. This could change the way KT is used by athletes, helping them potentially gain a competitive edge by increasing grip strength and resistance to fatigue. This study is not yet completed, and results will be available during the poster session.

## Public Opinion on Security in Post 9/11 World

**Brooklin Alexander**

Mentor:

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*Political Science*

In a post 9/11 world, national security is a hot topic for not only Americans, but many countries across the globe. This research focuses on the public opinion of what individuals perceive to be security. Additionally, my research looks at how certain factors such as race, gender, country of origin, and religion change one's outlook on security. These factors provide insight as to who is most likely to be hesitant for further security measures, as it may infringe upon their constitutional rights, and those who will advocate for tighter security, to allow for a safer country. My research findings showed that country of origin as well as gender were the two factors which provided varying public opinions on security measures.

## International Security and Human Rights

**Anna Benitez**

Mentor:

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*Political Science*

International security is a popular topic among politicians, scholars, and the general public. There are many factors that go into how individuals define international security, including human rights. This research examines how modern human rights crises are affecting the widespread definition of international security, and how states are working to adapt their definitions and policy. The main shift has been from a focus on state security to human security. Available literature has provided theories and definitions regarding human security and how policymakers adapt policies to pursue human security in an arena that is founded on state security. This project will use case studies to attempt to explain previous adaptations from state to human security efforts globally.

## Economic Impacts of the Arab Spring

**Colin Bennett**

Mentor:

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*Political Science*

In early 2011, throughout the Middle East and North African portions of the Arab world, several countries saw protests against authoritarian regimes that held power in the region. Tunisia, Egypt, Libya, and Yemen all saw regime changes as a result of these protests. In this project, I will investigate the political and economic changes that came about following the alterations in government types and leaders. I situate these cases within authoritarian to democratic regime changes since World War II.

## Foreign Aid and African Political and Economic Development

**Kiley Corcoran**

Mentor:

Dr. Virginia Beard,  
*Political Science*

The impact of foreign aid in African nations is a widely debated topic. Many scholars cite the positive impact of foreign aid on economic growth and political development among African nations, while others question its effectiveness. The question I am seeking to answer is: does foreign aid help states economically and politically, and if so, how much is needed to make a positive difference? This research relies on scholars such as William Easterly, Jeffrey Sachs, Joseph Stiglitz, Paul Collier, Amartya Sen, George Ayittey, Peter Uvin, and Dambisa Moyo to investigate if and how foreign aid has impacted freedom, democracy, and stability in African nations. To quantify freedom, I will be utilizing programs such as Freedom House. For democracy, I will be examining the changes in polity scores in relation to how much foreign aid a nation has received. And lastly, for stability, I will examine how many civil conflicts have occurred within the nation.

## Indigenous Women and Economic Position

**Kelly Fuhs**

Mentor:

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*Political Science*

Throughout the span of history, groups of indigenous women in Latin America have suffered from inequality and oppression. Although many of them have assimilated to the language and customs to the greater majority of others in their countries, they still suffer from great divisions between non-indigenous people. Collectively they endure poverty, illiteracy, and lower economic position than males and non-indigenous people (Radding 1993). Research shows that reasons for these inequalities include historical factors such as colonization and wars which have created a culture of violence and subordination of the women. (Williams 2012). What this project will explore is how educational and social barriers affect indigenous women's economic standing in Latin America. This is significant because the problem is deeply rooted and the history of violence has evolved into other social and educational barriers that affect the women today. This project will contribute to the general larger conversation of this subject by exploring the lack of indigenous female participation in the government, social and educational factors that perpetuate violence, how the laws put in place have failed to protect the indigenous women, and how all of this connects to indigenous women's economic standing.

## Does the Digital Divide Exist and How is It Affecting Africa?

**Michael Girman**

Mentor:

Dr. Virginia Beard,  
*Political Science*

As many countries in Africa and other parts of the developing world seem to lag behind in new technology access and use, researchers theorize that there is a so-called "digital divide" between the global north and the global south. This study seeks to find out the key factors that contribute the digital divide in Africa, if such a digital divide exists. Specifically I seek to find how cultural factors within African countries contribute to hesitancy or refusal of adoption of new technologies.

## Foreign Aid and the Impact on Foreign Development and Politics

**Lucy Gruber**

Mentor:

Dr. Virginia Beard,  
*Political Science*

A debate exists over the effects of foreign aid in developing countries. Political scientists, economists, government officials, non-profit workers, scholars, researchers, and foreign aid workers have been working to answer the question on whether or not aid is good or bad for development across African states. Foreign aid has become an industry within it self. Yet, is foreign aid a net benefit or detriment to recipients? This research will investigate this question both micro level foreign aid initiatives, such as setting specific goals for specific communities, as well as at macro level contributions of foreign aid, such as policies and political change in countries. Within this research, these type of questions must be assessed in relation to the measurement of the overall positive or negative affects aid has on communities while examining country's GDP, employment, birth rates, literacy rates, laws, NGO presence, and rates of aid given. Within this study, the role of matching programs, such as Tom's Shoes, will be explored in regards to the effects it has on the economies and well being of people in lower developing countries.

## The Digital Divide

**Taylor Hitchingham**

Mentor:

Dr. Virginia Beard,  
*Political Science*

This research project examines both the nature of the “digital divide” in sub-Saharan Africa as well as the divide in access to certain technologies and potential related effects on crop yields. The purpose of this research is to determine the extent to which the digital divide in sub-Saharan Africa affects crop yields. I hypothesize that areas with better access to technology will produce better crop yields and that countries in digital deserts will not show as profitable crops due to lack of cutting edge technology developed since the agricultural revolution. The natural effects of crop yields also have to be examined to determine how much of these differences in crop yields are due to natural geographical fluctuations.

## The Changed Face of Social Movements

**Jubilee Hosanna-Praise  
Jackson**

Mentor:

Dr. Virginia Beard,  
*Political Science*

Throughout history, significant events often shift societies. These transformations occur because of the urgent desire for change that sprouts from stirring issues which set hearts on fire, leading individuals to the brave option of a social movement in order to attain resolutions. Altering systems of society, institutions, and traditions allow them to achieve recognition, justice, and new opportunities that create a path toward an improved reality. However, with the effects of globalization on the advancement of technology has changed the face of functioning social movements. Is it possible that access to new computer-based technologies has caused social movements to shift from more individually-driven leadership forms to those that are more collectively driven? What factors influence the nature of social movements and the nature of social movement leadership?

### Does the Resource Curse Exist in Sierra Leone?

**Katie Lund**

Mentor:

Dr. Virginia Beard,  
*Political Science*

The resource curse- the negative effects of natural resources discovered, extracted, and exported in an area, state, or region- has been widely discussed by scholars studying African states. Sierra Leone, a country with massive quantities of natural resources, especially diamonds, has felt the negative effects of their abundance of natural resources. From one lens, the diamond industry is the key player in the resource curse experienced by many of Sierra Leone's citizens due to a lack of monitoring and enforcement of the revenue from exports. However, from a different lens, the diamond industry creates revenue that has helped certain areas of Sierra Leone's infrastructure, economy, and government. Does the resource curse exist in Sierra Leone, or does the diamond industry help boost the overall improvements of the country?

### Lingering Prejudice in Legislation

**Ridge Mannikko**

Mentor:

Dr. Virginia Beard,  
*Political Science*

A lot of research has been dedicated to the systemic prejudices faced by marginalized groups in the United States professional and collegiate athletic systems. However, the prevailing literature is missing research on the influence that high school coaches have on racial stereotypes in their athletic departments, and how they set the precedent for the ideals present among the next generation of athletes. Marginalized groups in this research include those with less power in the public arena and who are underrepresented in public decision-making bodies. The study will thus include such groups as women, LGBTQ+, Latinx, African Americans, Muslims, or other religious minorities. The study proposes to use the United States as a case study looking at existing high school athletic programs and their leadership including team managers, coaches, and other figures of power or influence in the department. This study is predicated upon the hypothesis that there are numerous prejudices faced by certain high school student athletes and not others, and the coaching staff and other department heads perpetuate some of these forms of prejudice. Together I hypothesize that both coaches and other department heads contribute to prevailing paradigms, and are prejudicial due to insufficiently regulated coaching practices and a lack of representation of marginalized groups.

### Kurds and the Syrian Civil War

**Collin Martin**

Mentor:

Dr. Virginia Beard,  
*Political Science*

Independence has become a somewhat prominent issue in the news, with the growth of several independence movements around the world in the past few years. Scotland, Kosovo, and, most recently, Catalonia, have all seen surges of pro-separatist politicians within the past 10 years. Rising tensions in Syria and the rest of the Middle East are fertile ground for separatist movements. In this research, I will investigate the effects the Syrian Civil War has had on the Kurdish independence movements of Syria, Iraq, and Turkey, exploring possible benefits and/or repercussions an independent Kurdistan would have on the area.

## The Resource Curse of Angola

**Carter Masek**

Mentor:

Dr. Virginia Beard,  
*Political Science*

Africa as a continent is very rich in natural resources. It is estimated that 65% of the world's diamond population rests in southern Africa, as well as nearly 10% of the world's oil output per year. Being a continent so rich in natural resources, how is it that Africa is home to so many of the world's poorest economies? For this study, I have chosen to look at Angola, and the relationship between its numerous resources and economic development/stability. Many would assume that their plethora of resources would help to build and strengthen the Angolan economy, however, the idea of the "resource curse" holds strong in Angola and many other African nations. The "resource curse" has plagued many African nations, and in this study, I examined whether or not Angola is also a victim. To do this, I have examined the political leadership and culture to determine whether or not they have had a positive or negative effect on the economic development of the nation. This project is set to examine whether or not Angola too faces the "resource curse."

## The Effects of Foreign Aid in Sub-Saharan Africa

**Ian McNamara**

Mentor:

Dr. Virginia Beard,  
*Political Science*

Does foreign aid help or hurt states in the global south? The literature surrounding foreign aid to African states is characterized in two prevailing categories. The first camp argues that aid has helped both politically and economically overall but not to its fullest potential. The second set of scholars argue that Western attempts in Africa have done more harm than good. Some of these further argue that African states are now at a point where they can help themselves accomplish the necessary structural and institutional changes. The goal of this research is to compare and contrast the arguments and evidence from scholars on both sides of this discussion in order to further answer the question on whether or not aid does more harm than good in international development and to suggest changes that could be made if aid is found wanting. Such changes could come either in the form of a change in how the aid is implemented or a change internally in African states. By contrasting positive and negative aspects of aid, as well as studying some suggestions, a better understanding of the direction aid should move in the future will be proposed.

## Political Polarization and Economic Health

**Derrick Perkins**

Mentor:

Dr. Virginia Beard,  
*Political Science*

As political polarization grows within the United States, partisanship is increasingly an impediment to cooperation in political settings. This division not only extends to lawmakers on the Hill, but also affects popular opinion among Americans. As partisan gaps widen on political issues, it has become harder for citizens to separate their political views from their assessment of the economy. Such gridlock in Congress has prevented positive actions towards rejuvenating the economy as a whole which intern affects directly the entirety of the American population. This research proposal hopes to establish a measurable negative connection on the micro/local economic level of how these actions/inactions and mindsets taken by both congress and and state legislators have had a destructive effect on economic elements such as individual/household income, consumer consumption, net economic output, and local financial markets. In conclusion through recent indecision and gridlock of lawmaking bodies there has been a statistical connection resulting in poorer economic health and development in comparison to times of greater partisan cooperation of those respective bodies.

## Clash between International Organizations: Resolving Conflicts

**Bianca Reyes**

Mentor:

Dr. Virginia Beard,  
*Political Science*

Conflict resolution is one of the most researched topics due to its importance and relevance in any given period. Previous research has explored the factors that enable international organizations (IOs) to be more effective in conflict resolution and mediation. It has been found that highly structured intergovernmental organizations (HSIGOs) with a mandate on security diplomacy and enough resources have the ability to alter state behavior and intervene in conflicts if necessary. However, it has not been considered how a HSIGO can be limited or affected by the presence of other HSIGOs working on the same conflict case. This paper expands on the existing literature and looks at the drawbacks and benefits of having more than one HSIGO resolving or mediating a conflict. It will analyze their relationships and interactions during past conflicts to increase their effectiveness in future conflicts.

## Democratic Socialism in Africa

**James Rogers**

Mentor:

Dr. Virginia Beard,  
*Political Science*

In this research presentation, I will examine the positive and negative impacts and influences of religion in the economic development of African nations. Due to limited access to information and a finite amount of time, I will be focusing on two religions: Islam and Christianity. Through the analysis of religious freedoms, religious diversity and rule of law, as contrasted with economic development, which includes an assessment of private and public industry, human rights, key demographics and shifts in GDP. I hope to provide a clearer depiction of the role of religion in the economic development of African nations.

## Factors Leading to Catalonia's Independence Movement

**Eric Rosendahl**

Mentor:

Dr. Virginia Beard,  
*Political Science*

Revolutions through time have led to many changes in the world's social-political climate. For these independence movements to occur, there must be an occupier and an occupied group of people. Yet, what factors lead to the activation of occupied groups of people into independence movements? Previous scholarship on specific case studies often explain outcomes of such movements as well as efforts taken within independence movements, but the factors that lead to independence movements are usually only mentioned as an afterthought. This research will thus focus specifically on conditions prior to independence movements that lead to the beginnings of an independence movement, using Catalonia's bid for secession as a case study.

## Reconciliation Efforts and Peace Building in South Africa

**Edgar Samaniego**

Mentor:

Dr. Virginia Beard,  
*Political Science*

The purpose of this research is to identify what factors are seen to make reconciliation efforts/peace building efforts more or less effective. Apartheid was a serious racial issue that happened in South Africa between 1948 to 1991. I will apply existing research the positive and negative outcomes of the TRC on societal reconciliation and peace-building to the cases of the 1994 Rwandan genocide and the civil conflict from 1991 to 2002 in Sierra Leone.

## The Relationship between Religious Affiliation and Voter Turnout

**Matt Scheneman**

Mentor:

Dr. Virginia Beard,  
*Political Science*

Much research has been done on the relationship between religious identity and political behavior among Americans. This study aims to examine how religious affiliation affects how Americans vote, specifically if evangelical Christians vote more or less. Studies have already shown that evangelicals do not necessarily have a higher turnout rate than others and that a higher church attendance does not correlate with increased political participation. This study will find if evangelical Christians vote more or less than others with different or no religious affiliation.

## The Democratic Republic of the Congo and the Resource Curse

**McKenna Stam**

Mentor:

Dr. Virginia Beard,  
*Political Science*

Does a resource curse—the negative impact of high-valued natural resources on state stability—plague nations in sub-Saharan Africa? This project examines evidence that both supports and argues against the resource curse, using the Democratic Republic of the Congo (DRC) as a case study. The DRC is a country with an abundance of natural resources, including precious metals, gems (specifically diamonds), oil, and minerals. The DRC has been in almost constant turmoil since colonization. Some scholars argue that the cause of this turmoil is different groups and leaders attempting to control the resources, while others argue that although the resources may contribute to conflict, issues in the DRC are rooted deeper than just the resources available. Thus the DRC offers an strong example of a country in which to test the relationship of resources and other factors to conflict and stability.

### Shut-ins in Japan: Culture-bound or Psychological

**Savanah Stewart**

Mentor:

Dr. Virginia Beard,  
*Political Science*

Hikikomori in Japan—“pulling inward, being confined,” i.e., “acute social withdrawal” are reclusive adolescents or adults who withdraw from social life, often seeking extreme degrees of isolation and confinement—has recently become a prominent issue of concern and study. Currently, therapists largely wonder how to best treat Hikikomori. This project will investigate the various reasons behind Hikikomori occurrence and relate factors causing Hikikomori to treatment options. Initial findings suggest that how the syndrome starts largely impacts how it can best be treated.

### The Impact of Foreign Aid in Sub-Saharan Africa

**Allison Tooley**

Mentor:

Dr. Virginia Beard,  
*Political Science*

In the late 1800’s, the Scramble for Africa took place, resulting in an influx of European colonization, influence, and aid. These countries were receiving benefits from their involvement in each colony. Post colonization, African states began to receive foreign aid from countries that did not have a direct claim or stake in the nation. Within the existing research, there is a division on the benefits of foreign aid in sub-Saharan African states. Certain researchers believe that aid does not have a direct correlation to economic and political growth, while others believe that aid, when used and invested well, can benefit the growth of a country. This research will explore the proposed correlation between foreign aid and growth and the impacts this has on a country’s progress toward democracy.

### How Can Nations Work Multilaterally to Decrease Rates of Global Sex Trafficking?

**Sophia Vander Kooy**

Mentor:

Dr. Virginia Beard,  
*Political Science*

This research analyzes the existing international frameworks, multilateral efforts, and attempts at domestic solutions to lower the rate of global sex trafficking on a global scale. Sex trafficking is a layered, holistic, and unmalleable problem. The majority of past attempts to lower the global rate of sex trafficking revolve around treating sex trafficking through the lens of a specific entity. Different nations and organizations have treated the problem as if entangled with border security, drug smugglings, and other forms of human trafficking to name a few. This research draws from mostly primary sources that include conventions and declarations from the United Nations and others IGOs. Through understanding the effectiveness of past attempts, a solution to lowering the global sex trafficking rate that treats sex trafficking as the layered, holistic, and malleable problem it is can be uncovered.

## Why Do Citizens in West Michigan Own Firearms?

**Jacob Wilson**

Mentor:

Dr. Virginia Beard,  
*Political Science*

In America today guns are once again the topic of extreme debate in light of the Las Vegas and Parkland mass shootings. The purpose of this study is to investigate more fully the reasons and motives behind why people own firearms, and the rationale gun owners use to justify still owning firearms in the wake of atrocities. In this study, I will use West Michigan as a case study. I will situate survey findings from gun owners in West Michigan within previous studies on firearms, gun control, and attitudes towards firearms to add to general understandings on the key reasons that exist for owning firearms.

## Syrian Identity in Civil War: A Content Analysis of Political Actors

**Leigh Wynveen**

Mentor:

Dr. Joel Toppen  
*Political Science*

undertones of a battle for Syrian identity. Through identity politics, a group may seek to create legitimacy, unity, or division. This research examines how domestic political actors in the Syrian Civil War apply identity politics and its implications on the conflict. By utilizing a multi-method content analysis, the themes and purposes of identity politics are uncovered in the speeches of President Bashar al-Assad and the oral and written communication of the Opposition. Quantitative and qualitative analyses display the latent and manifest meanings of the identity politics. This research applies and extends Allport's In-Group, Out-Group Theory by showing how identity politics can be used to create divisions between groups based in identity and culture as well as unite warring factions. The data displays that both the regime and Opposition employ unifying indicators in order to mold a Syrian identity based in their politics. Thematic analysis also displays that identity politics are used to create enemies outside of Syria's borders and to form a Syrian front against foreign powers. This examination of the actor's communication displays that the Syrian Civil War is not purely an ethnic conflict.

“Dear Diary, I’m  
Feeling...”: Within-  
Country Diversity  
in Guatemalan  
Adolescents’ Gratitude  
and Hassles

Alyssa Arens

Katelyn Poelker

Judith Gibbons

Natalia

Mariscovetere Fanjul

Colleen Maxwell

Jim Dolan

Mentor:

Dr. Katelyn Poelker,  
*Psychology*

Gratitude is associated with subjective well-being in adolescents while hassles or everyday irritants likely detract from well-being. In Guatemala, a country with one of the highest rates of economic inequality in Latin America, adolescents’ experiences with gratitude and hassles may differ depending on socioeconomic status (World Bank, 2015). In the current qualitative study, we analyzed the within-country diversity of Guatemalan adolescents’ gratitude and hassles. The sample ( $N = 80$ ) included data from two Guatemalan schools as part of a larger study. The first school served underprivileged youth ( $n = 37$ ,  $M_{age} = 14.35$ ,  $SD = 1.11$ , 48.6% girls), and the second served a middle-class population ( $n = 43$ ,  $M_{age} = 15.77$ ,  $SD = 1.15$ , 51.2% girls). Participants were randomly assigned to write about either their daily “gratitude” or “hassles” for 10 days. Journal responses were coded using thematic analysis (based on Braun & Clarke, 2006). Regarding gratitude, participants from both samples displayed appreciation for relationships with others and the support linked with those friendships, family members, and teachers, among others. However, hassles results showed distinct patterns between the samples. Students from the middle class school were often hassled by less severe hassles (e.g., waking up early) or by enduring the betrayal of false friends. Adolescents with few resources frequently mentioned feeling left out, ignored, and disrespected. Furthermore, distinct from the higher resource group, students with fewer resources mentioned feeling upset that close others experienced unkindness. Both groups shared negative experiences with peers, but the adolescents with more resources frequently reported indirect or relation aggression (e.g., gossiping, fakeness), versus the direct forms of unkindness (e.g., teasing) experienced by the adolescents with fewer resources. Such implications should be considered by school administrators to assess the needs of their students, and construct sample-specific interventions to foster gratitude and reduce hassles, thus promoting well-being.

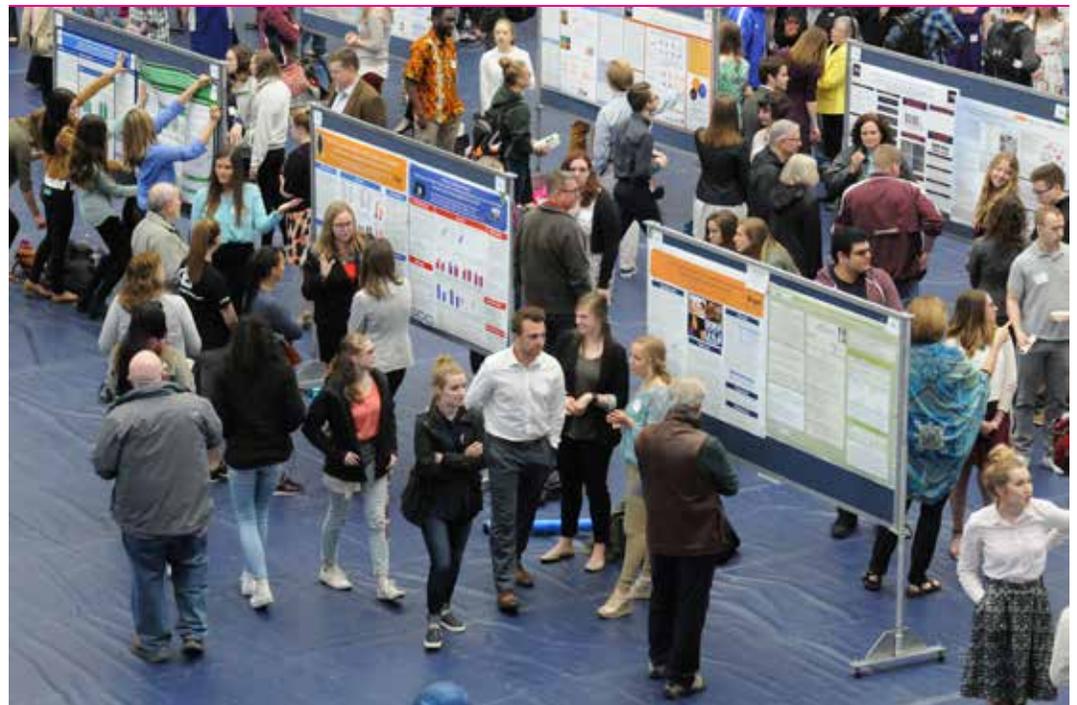
## Flourishing, Affect, and Racial Attitudes

Haila Asefa

Mentor:

Dr. Sonja Trent-Brown,  
*Psychology*

Recent political changes and increased conversation around racial injustices has caused a rise in racial tension in the United States (JBHE, 2017). Much of the educated conversation around race happens on college campuses. However, many instances of racism have come to attention in institutions across the country, and social media has amplified students' messages into broader society. The rising of racial harassment in schools has led to increased demonstrations by students in various universities (USA Today, 2016). Based on these instances and on the current racial atmosphere, we examine whether similar issues are present within our campus, and how they impact the flourishing of our students. Over 800 undergraduate students completed an online questionnaire including the Racial Attitudes Survey (RAS) (Lewis, 1999), the Positive and Negative Affect Schedule (PANAS) (Watson & Tellegan, 1988), and the Mental Health Continuum-Short Form (MHC-SF) (Keyes, 2014). We used the RAS, PANAS, and MHC-SF to investigate the contribution of racial attitudes to students' flourishing. Overall, we predicted a positive relationship between PANAS and MHC-SF scores. We expected that high scores on the RAS would predict lower scores on the PANAS and MHC-SF for African American participants and higher PANAS and MHC-SF scores for White participants. We also anticipated that African American respondents would report significantly higher acceptance scores on the RAS Social Distance subscale and that White participants would report higher flourishing and affect scores overall. Our study was conducted in order to address possible racial issues in our college in positively effective ways. Additionally, we hope to gain better understanding of how we can build communities in which students from different backgrounds can flourish together. Furthermore, since the literature on racial attitudes linked to flourishing in college students is limited, we hope to add better understanding of the subject and encourage further research.



## Logic vs. Intuition: When Do Implicit and Explicit Mate Preferences Predict Relational Outcomes?

**Juliette Collins**

Mentor:

Dr. Carrie Bredow,  
*Psychology*

Research is scarce regarding the circumstances under which implicit and explicit mate preferences predict people's relationship outcomes. Though implicit preferences may be important in early face-to-face interactions, while explicit preferences may operate in more deliberate contexts (Eastwick, Eagly, Finkel, & Johnson, 2011; McNulty & Olson, 2015), the details of their situational functioning remain unclear—particularly in ongoing relationships. Using three waves of data on people's implicit and explicit mate preferences, this study addresses this shortcoming by examining if and when the correspondence between implicit versus explicit standards and partner characteristics predicts concurrent relationship outcomes.

The participants consisted of 189 unmarried adults ranging from 19 to 71 years old and were recruited from Amazon Mechanical Turk (MTurk). As part of an online study, participants completed a series of three single-category association tests (SC-IATs) which assessed people's unconscious desires regarding the importance of the trait dimensions attractiveness/vitality, status/resources, and warmth/trustworthiness in a long-term partner. Subsequently, participants completed explicit measures of their reported mate preferences regarding the aforementioned trait dimensions, as well as their relationship satisfaction, relationship commitment, and their current partner's characteristics. Participants also answered questions regarding potential moderators of the relationship between preference-partner fit and relational outcomes. This procedure was then repeated at a three-month and six-month follow-up.

Overall, multilevel models revealed that the match between people's explicit or implicit preferences and their ratings of their partner's traits was not associated with their relationship evaluations. However, several significant moderators were identified that appeared to be masking deeper results. For individuals who reported thinking about their criteria more extensively (those who expressed high "standard salience") greater explicit preference-partner match predicted more positive relational evaluations; this was not so for those who reported low standard salience. For individuals who reported often following their intuition (those who expressed high "reliance on gut feelings") greater implicit preference-partner match predicted more positive evaluations; this was not so for those who reported low reliance of gut feelings. These results suggest that explicit preferences might have more predictive validity for individuals who tend to think extensively about their standards. Meanwhile, implicit preferences might have more predictive validity for individuals who tend to make decisions based on their intuitive feelings.

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## The Effect of Sleep Quantity and Quality on Working and Narrative Memory and Memory for Design in Preschoolers

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**Rebecca Messnick**  
**Elizabeth Vizcarra**  
**Mary-Kate Szuma**  
**Lakna Jayasinghe**  
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*This research was supported  
by the Caplan Foundation for  
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This study analyzes the effect that both quantity and quality of sleep have on the cognitive functioning of memory in preschoolers. Previous research has found that most preschoolers regularly experience disruptive sleep-related behaviors (National Sleep Foundation, 2004). Sleep is especially crucial during early development to promote health, education, brain development, physical growth, and quality of life (National Sleep Foundation, 2004; CDC, 2015; Anders, et al., 1980). Data was collected for a duration of 12 weeks via Fitbits™ and researchers assessed participants using the Children's Sleep Hygiene Scale which screened for light exposure, music, and caffeine intake. Parents were asked to complete a questionnaire with higher scores indicating greater sleep hygiene. These tests of sleep hygiene allowed researchers to collect sleep quality data while the Fitbits™ collected sleep quantity data. Memory assessments including the Missing Scan Task for working memory and the NEPSY-II for both narrative memory and memory for designs evaluated participants memory. Higher scores in each of these assessments of memory indicated better memory. A linear regression model will be used to investigate the relationship between sleep quantity/quality and memory scores. We hypothesize that participants with higher sleep quantity and quality will perform better in memory assessments. If our hypothesis is correct, the data will show the importance of sleep for development and academic performance in preschoolers. This may also provide new insight into the role quality of sleep plays in cognitive functioning.

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## Does Your Occupation Affect Your Preschooler's Sleep?

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Past research on different characteristics associated with authoritarian parenting, such as low stress levels, solid support, and high levels of responsiveness, have been linked to executive functioning and stronger working memory. Furthering the research is crucial to the field of psychology to better understand how parenting styles impact memory which also influences the child's future relationships and academic achievement. According to Merz et. al. (2016) and Wagner et. al (2016), a responsive parenting style, characteristic of authoritative parenting style, will have a greater positive effect on memory than authoritarian and permissive parenting. The current study focuses on the relationship between parenting styles and memory. Preschool-aged children's memory will be assessed at the beginning and end of the 12-week study. A neuropsychological assessment (NEPSY-II) will be used to test both narrative memory and memory for designs while the Missing Scan Task will be used to test working memory. Parents will complete the parenting styles and dimensions questionnaire (PSDQ) to identify which parenting style they use. To analyze this data, an ANOVA test will be performed to compare memory scores for each of the parenting styles as well as a paired sample t-test to compare memory before and after the 12-week period. We hypothesize that authoritative parenting will yield the highest memory scores, while permissive and authoritarian parenting will yield lower memory scores. We also hypothesize that the memory scores will remain the same throughout the study. Past research has found that supportive parents are more closely associated with a stronger working memory and that responsive parenting is also linked to higher executive functioning. By better understanding the relationship between parenting styles and memory in preschoolers, the field can be better equipped to educate parents, teachers, and schools on the most conducive way to strengthen children's memory and executive functioning.

Self-Regulation as  
an Underpinning  
Mechanism of Virtue

This abstract is not available online.

**Erin Freiburger**  
**Kerri Knoll**  
**Emma DuMez**

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## The Key to a Good Night's Sleep in Childhood: Child and Parent Sleep Hygiene Practices Predict Sleep Quality

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**Lauren Evert**  
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*This research was supported by the Caplan Foundation for Early Childhood.*

We are examining predictors of quality sleep in preschoolers. Sleep difficulties are present in 25-40% of children, and many sleep problems are a result of poor sleep hygiene; in fact, previous research supported the relationship between healthy sleep hygiene and quality sleep in children (Mindell, Meltzer, Carskadon, & Chervin, 2009). Sleep hygiene refers to the malleable behaviors of parents and children that lead to restorative sleep including daytime activities and preparing the sleep environment. Sleep quality includes sleep duration and healthy onset latency (Mindell et al., 2009). Considering the frequency of children's sleep problems due to poor sleep hygiene, we are assessing what leads to quality sleep in children.

Our research team is recruiting preschoolers and collecting data from their parents. Child sleep hygiene and parents' awareness of their child's sleep hygiene are being assessed. Parents respond to the Children's Sleep Health Screen (CSHS) via questionnaires. This scale measures the parents' reports of their child's engagement in sleep-related behaviors. The children's reports of sleep hygiene are being collected via the Children's Sleep Hygiene Scale wherein the preschoolers use a visual scale to indicate their bedtime routines and perceived importance of healthy sleep practices. Higher scores on both measures indicate more successful sleep hygiene. Several measurements of child sleep quality are being collected via FitBits® on preschoolers' ankles, including sleep duration (longer=higher sleep quality) and restlessness (less=higher sleep quality).

We are using a multiple linear regression model to examine the relationship among scores on the CSHS completed by parents and preschoolers, and child sleep quality as assessed by FitBits®.

Our novel study is exploring sleep hygiene practices in children and their parents, while also directly examining children's quality of sleep. We hypothesize that higher sleep hygiene scores from both the parents and the children will predict better children's sleep quality.

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## Effects of High-Fat Diet Consumption on Circadian Rhythms and Cognition in Nile Grass Rats

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Mentors:

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*Supported by the Hope College  
Neuroscience Program.*

Obesity is a rising global public health crisis with serious consequences ranging from metabolic to cognitive dysfunction. High-fat diet (HFD) consumption, a common cause of obesity, increases risks for comorbid metabolic, cardiovascular, and cancerous diseases. Furthermore, HFD alters circadian rhythms of feeding behavior and activity (Kohsaka et al., 2007) and impairs hippocampal memory in juvenile rats (Boitard et al., 2014). Our current model investigates the effects of HFD on circadian rhythmicity and learning, memory, and anxiety in the Nile grass rat (*Arvicanthis niloticus*), a diurnal rather than nocturnal species, providing a more relevant mechanistic understanding for human health. Locomotor activity data has been collected from 18 Nile grass rats under both standard 12-hour light:12-hour dark (12:12 LD) cycles and in two weeks of constant darkness using cage-top infrared sensors. After 10 days of baseline activity recording, half of the animals received a high-fat diet chow, while the other half remained on control chow for the duration of the study. Body weight, food consumption, and locomotor activity were monitored under these various lighting conditions. Effects of HFD exposure on memory and anxiety-like behavior were assessed through behavioral tests including the elevated plus maze, open field test, spontaneous alternation test, novel object recognition test, Morris water maze. Analyses in 12:12 LD indicate that HFD exposure disrupted locomotor activity, as indicated by periods of arrhythmic behavior, whereas controls displayed normal activity patterns. In constant darkness, HFD grass rats appeared to increase overall activity levels. We also expected the display of cognitive deficits and increased anxiety-like behavior in HFD grass rats. Our investigation will provide a basis for understanding the potential biological connections between the cognitive and circadian consequences of a high-fat diet.

Outside, Now!  
Parental Practices  
Shape Their Children's  
Activity Preferences  
and Behaviors

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**Kara Lurvey**  
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Nature once characterized a vital component of childhood and development. However, modern lifestyles are rapidly changing the way in which individuals choose to interact with the natural world, shifting the balance towards increased technology use (Rideout et al., 2006). Parental attitudes and behaviors are important for shaping childhood pastimes. Leary et al. (2008) reported that parental activity preferences correlated with their preschooler's activity preferences. Rodenburg et al. (2013) also found that healthy parent practices corresponded to healthy child behaviors. Given the relationship between parental attitudes and childhood physical activity, we expected that parental practices would also impact time spent outdoors and technology use. A 57-item survey explored college students' experiences and perceptions of nature and technology. Students were asked to recollect parental influence on childhood activities and respond to questions about engagement in and enjoyment of these activities during childhood and presently. Parental requirement of outdoor time significantly correlated with decreased encouragement of screen-time play, and more parental restriction of indoor activities, physically sedentary activities, and electronics use. Parental requirement of outdoor time correlated with recollections of spending more time outdoors during childhood and as adults. These participants valued time spent in nature and thought nature was more important for learning. Respondents who had outdoor requirements engaged with personal electronics at later ages. These trends are evident in their current electronics usage as they spend less time with electronic media per day. Outcomes indicate that parental requirement of outdoor time was related to persistence in their children's preference for engagement in outdoor and physically active activities as adults. Parental restriction of electronics use was also related to their children's interactions with and perceptions of technology. These results suggest that educating parents regarding the importance of encouraging outdoor time could be a key target for inciting lasting change in children's behavior.

## Does Superman Make Us More Helpful? The Effect of Hero Priming on a Behavioral Measure of Helping

**Russell Haupt**  
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Mentors:

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*We are grateful for support from the Towsley Research Scholars Fellowship. This project was made possible through the support of a grant from the John Templeton Foundation. The opinions expressed in this publication are those of the authors and do not necessarily reflect the views of the John Templeton Foundation.*

Heroes often represent or exemplify idealized values such as justice, sacrifice, and prosocial behavior. These embodied ideals are thought to have an effect on an individual's self-concept and behavior. Past research has examined the effects of priming individuals to affect aspects of their self-concept and behavior, finding that the priming can change aspects of an individual's behavior (Wheeler, DeMarree, & Petty, 2013).

The current study examines the effects of priming individuals with fictional superheroes. We hypothesized that individuals primed with fictional superheroes (e.g., Superman) would be more likely to help than those primed with a neutral image. One at a time, participants from Hope College ( $N = 123$ ) completed short surveys in a room containing either a small Superman poster (hero prime) or a bike poster (neutral prime). Part of the survey involved directing attention to the contents of the room, in order to increase the likelihood that the prime would be noticed. After completing the survey, the participant was informed he or she had finished the survey early. Research assistants then informed the participants they had the option to end the session and leave or stay and volunteer to help the experimenter develop a new scale. If participants opted to stay and help, the length of time they stayed and how many ratings they provided for the scale were recorded. Prior to debriefing, both those who stayed and those who opted to end the study early completed one final survey measuring his or her meaning in life.

Using Chi-Square tests, our hypothesis was confirmed as individuals in the hero condition helped more frequently than those in the control condition  $\chi^2(1, N = 123) = 5.779, p = .016$ . However, there was no significant effect of priming poster on how long the participant helped, how many ratings they provided, or on the participant's meaning in life.

## Associations of Religiousness, Spirituality, and Sleep

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**Rudy Kelly**  
**Jordan Benjamin**  
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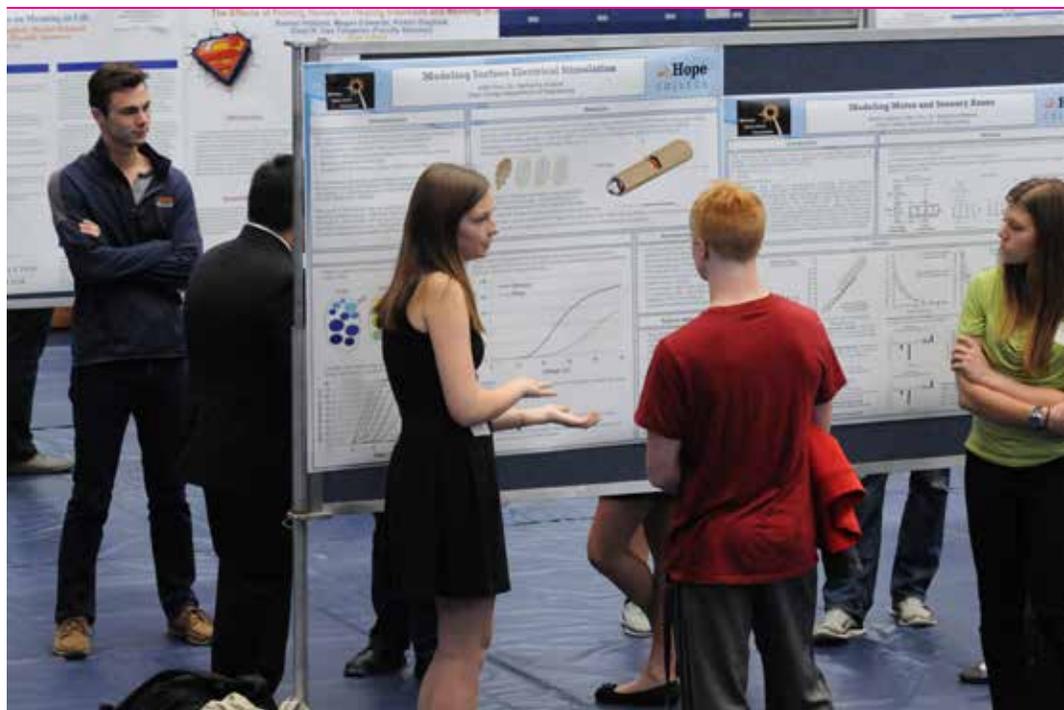
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*We are grateful for support from the Towsley Research Scholars Fellowship. This project was made possible through the support of a grant from the John Templeton Foundation. The opinions expressed in this publication are those of the authors and do not necessarily reflect the views of the John Templeton Foundation.*

Religion is a very important factor in the lives of millions of Americans (Pew Forum on Religion and Public Health, 2015). Religiousness and spirituality have been shown to have a reliable but often complex association with health and health behaviors including sleep (Cheadle & Dunkel Schetter, 2017; Ellison, Bradshaw, Storch, Marcum, & Hill, 2011; Hill, Ellison, & Musick, 2006). In order to explore the connections between religion, spirituality, and sleep thoroughly, we examined the connections between an individual's spirituality, religiousness, and health behaviors, including sleep, using daily diary methodology.

Our sample consists of 168 undergraduate students. Participants first completed a pre-survey in a laboratory setting to measure multiple aspects of the participants' lives, including health, exercise, religion, and spirituality. During the week following the completion of the baseline pre-survey, participants completed online daily diary surveys before noon each day. The daily diaries collected information about the participant's behaviors and experiences within the previous 24 hours including religiousness and spiritual behaviors and experiences as well as their prior night's sleep quality, quantity, hygiene, and beliefs.

We hypothesized that participants with higher trait religiousness and spirituality would have better self-reported sleep quality and quantity. We also hypothesized that participants with relatively more daily religious and spiritual behaviors and experiences would report better sleep quality and quantity, both within the same day and the next day. Several positive associations were found between religiousness, spirituality, and better sleep, potentially indicating that certain religious activities on certain days are associated with more sleep.



## Having the Number They Want: Empowerment of Latin American Women

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Empowerment, an individual's ability to exercise authority and control over their life, can be expressed in a variety of ways. One indicator of empowerment affecting women is their ability to have their ideal number of children. However, culturally imposed gender roles may pose a barrier to women's empowerment. In Latin American culture, machismo promotes hyper-masculinity and Marianismo encourages women to embody the Virgin Mary. This study assessed the relationship between empowerment of Latin American women and their ability to have their ideal number of children. Empowerment was measured with respect to educational, economic, social, and contraceptive domains using Demographic Health Survey data ( $N = 25,996$ ) from Colombia ( $n = 12,458$ ), Guatemala ( $n = 7,168$ ), and Honduras ( $n = 6,370$ ). A series of Analyses of Covariance (ANCOVA) tested indicators of women's empowerment with respect to their number of living children while controlling for their ideal number. Education was a significant means of empowerment in all three countries studied, as women with higher levels of education had fewer children. Economic decision-making was significantly related to the number of children for women in Guatemala and Honduras. Colombia, the wealthiest country, had no significant findings in the economic domain. Social empowerment, however, was particularly powerful there (e.g., making healthcare decisions). Colombian and Honduran women with knowledge of contraceptives reported having fewer children. Findings can be used to empower women in country-specific programs. Educational programs would serve as a means of empowerment for women in all three countries. Programs with an emphasis on contraceptive education would benefit women from Colombia and Honduras, while social programs would be most relevant for women from Colombia. Guatemalan and Honduran women stand to benefit from both social and economic empowerment programs. Overall, the goal is to increase women's independence and ownership of decision-making in their lives.

Perceptions of  
Forgiveness-Seeking  
Impact Forgiving  
Responses and  
Relationship Quality

**Kerri Knoll**  
**Erin Freiburger**  
**Emma DuMez**  
**Hannah Bugg**

Mentor:

Dr. Lindsey Root Luna,  
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This abstract is not available online.

## Associations of Intentions and Perception of Social Norms on Health Behaviors

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**Reagan Spindler**  
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### Mentors:

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Most deaths in the United States result from chronic illness. Health behaviors contribute to and protect from chronic illness (Taylor, 2014) and are predicted by self-efficacy as well as self-monitoring and regulation (Anderson, Winett, & Wojcik, 2007). In particular, Social Cognitive Theory (SCT) has been used to predict health behavior change and health promotion in adults from self-efficacy and self-monitoring. Self-efficacy and monitoring are related to intentions to engage in health behaviors which also predict actual health behaviors. A meta-analysis of 47 studies on health intentions and behaviors found that a medium to large change in intentions was predictive of a small to medium change in behavior (Webb & Sheeran, 2006). Social groups also play a significant role in predicting health behaviors. For instance, a study by Boyle, Mattern, Lassiter, Jill, and Ritzler (2011) found that college students who received peer education regarding physical activity increased their activity levels significantly in comparison to their peers who did not receive peer education. Furthermore, a meta-analysis by Best, Miller, Eng, and Routhier (2016) found that peer-led self-management programs are effective at increasing minutes spent doing physical activity weekly. We conducted a seven-day daily diary study of health behaviors among 168 college students. Health behavior intentions and perception of social norms were measured prior to the daily diary through a pre-survey. Sleep and physical activity were measured daily. We are currently analyzing our data. We predict that participants' intentions will be predictive of health behaviors. We also predict that the participants' perception of their own social group's health behaviors will be predictive of their own. These findings could be useful in understanding and promoting healthy sleep and exercise on college campuses. Understanding how perceptions of social norms and intentions affect health behaviors could guide impactful intervention strategies for college students, which is important for increasing students' overall health and achievement.

## Measurement of Resilience in Undergraduate Students

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**Trevor Sooy**  
**Allie Thiel**

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The present study aims to identify factors that contribute to an individual's capacity for resilience and the resilience resources that are available to them. We define resilience as the process of withstanding and coping with demands while maintaining healthy functioning in various life domains, including academic and social (Glantz & Sloboda, 1999; Rutter, 1996). Resilience resources are defined as resources that promote the ability to withstand and cope with stress (Dunkel Schetter & Dolbier, 2011). The most frequently identified resources associated with both mental and physical health include self-esteem, social support, religiousness and spirituality, trait or dispositional optimism, and mastery (Dunkel Schetter & Dolbier, 2011). Currently, there are no adequate measures for resilience in emerging adults. We are testing the reliability and convergent and discriminant validity of the newly developed Resilience Resource Scale, a brief measure of resilience designed for use with emerging adults (RRS; Julian, Cheadle, Knudsen, Bilder, Dunkel Schetter, *under review*). We are in the process of investigating how this new RRS measure will correlate with established measures of other constructs by conducting a survey with students in the psychology subject pool at Hope College. We expect a sample size of 150 students. We anticipate the RRS to be positively associated with the other resources measured such as positive affect and optimism and negatively associated with symptoms of anxiety and depression.

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## Correlates of Religiosity and Body Esteem in Women

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Women face mixed evaluations of their bodies. Society's beauty standards suggest their bodies are flawed; Church and the Bible suggest their bodies are blessed and serve a higher purpose. Women who based their self worth on appearance reported lower body esteem, whereas women who based their self worth in God reported higher body esteem (Inman & Witvliet, 2017; Overstreet & Quinn, 2012). We compared women who more heavily based their self-worth on religion than society's beauty standards to women who do the reverse. The former group's stronger optimism, meaning in life, flourishing, and Attitudes Towards God (feeling loved by God) might explain (mediate) why the former group reported higher body esteem. We tested these relations, above and beyond body mass and positive affect. Female college students (N = 88) completed scales of body esteem, conditions of self-worth, optimism, flourishing, presence of meaning in life, and positive affect among a few other scales. We subtracted a person's appearance-based self-worth score from her God-based self-worth score to create our main predictor variable. As expected, the predictor (heightened God-based self-worth) and the mediators were positively related to body esteem. Four hierarchical regressions (testing mediation) were run. Demographics (body mass, positive affect) were entered first predicting body esteem. Next, the predictor predicted body esteem. Then each of the mediators were separately entered in their own regression. Each mediator explained additional variation. Also, the relationship between the predictor and body esteem remained significant even after optimism, meaning in life, or flourishing were entered. This relationship was weakened when positive attitudes to God was entered. Religiosity's positive relation to body esteem does not appear to be due to one's optimism, meaningful life, flourishing, or low body mass. Rather, it's more likely due to feelings of being unconditionally loved by a nurturing reliable God.

## Who Said What How? Acoustic Parameters of Child Speech

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**Diana Cortes**

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*This research was supported by the John H. and Jeanne M. Jacobson Fund.*

Prior research demonstrated that vowels are acoustically specified based on their formant frequencies (Peterson & Barney, 1952; Hillenbrand et al., 1995). Measures have been established for adult speakers across gender, but these classic studies included neither measures with respect to ethnicity nor acoustic targets for child speakers across age, gender, and ethnicity. This study investigates vowel production across these demographic characteristics for 8- to 12-year-olds. There is a gradual lowering of the voice with the onset of puberty beginning as early as age 10 (Berger, 2008). The fundamental frequency of a child's voice lowers as well, influencing the phonological space, which could result in differences across gender, especially for the 11- to 12-year-olds. Children recorded neutral consonantal context /h-vowel-d/ words (e.g. hid, head, had) and sentence-length stimuli (I hear the sound of who'd some more). The /hVd/ words contained one of 12 General American English vowels as well as three diphthongs for a total of 30 utterances per speaker. We hypothesize that fundamental and formant frequencies will vary significantly in pitch and intensity across age and gender. For ethnicity, we predict that the voices of 8 and 9 year olds will not significantly differ between African American and European American speakers, while at the ages of 10-12 we anticipate significant differences. Outcomes will describe the acoustic variation in vocalic production in European American and African American children and 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 the stability of the acoustic parameters for child speakers and determine the ages at which 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.

## Who Said What Now? Accuracy and Confidence of Child Speaker Identification

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**Jon Chiczewski**  
**Diana Cortes**

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*This research was supported  
by the John H. and Jeanne M.  
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Adult listeners can successfully identify adult speaker gender and ethnicity (Thomas & Reaser, 2004), but less is known about speaker identification in childhood. Following the onset of puberty, acoustic parameters related to voice quality begin to change, enabling listeners to reliably identify voice quality characteristics (Berger, 2008). This study examines how listener gender and ethnicity impacts accuracy of gender and ethnicity identification of child speakers. Male and female European American and African American children ages 8-12 produced words (e.g., heed, hid, hayed) and sentences (I hear the sound of heed some more.) in General American English. Adult listeners completed a language background questionnaire including questions regarding their experiences with children and listened to four blocks of recordings (sentences/words, forward/reverse). Listeners identified ethnicity, gender and how confident they were of their choice. We expect that accuracy and confidence of speaker ethnicity will be higher when listeners and speakers share ethnic backgrounds. Although we anticipate that male speakers will be more accurately and more confidently identified, we also expect that gender group membership will increase accuracy and confidence. We also anticipate that accuracy of identification will improve with speaker age. Finally, we expect that listeners with greater frequency and enjoyment of interaction with children will demonstrate higher accuracy and confidence scores. This study will provide insight about the impact of a child speaker's age on the ability of an adult listener to identify their gender and ethnicity. Outcomes can be informative for professionals working with children and for speech-related practitioners. Variable accuracy in recognizing differences in speakers' gender or ethnicity based on personal language experience may lead listeners to make stereotypical assumptions and respond in ways that reflect implicit biases. Teachers, voice therapists, and speech-language pathologists can utilize this knowledge to reduce biases in their work.

## Parenting Styles, Preschoolers, and Memory

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**Grace Ditzenberger**  
**Carolina Marshall**  
**Bradley Dixon**  
**Alyssa Goodwin**  
**Darby Baird**  
**Erin Freiburger**  
**Lakna Jayasinghe**  
**Lauren Evert**  
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*This research was supported  
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Past research on executive functioning found that higher amounts of parenting stress, characteristic of authoritarian parenting, is associated with poorer executive functioning, including memory (Wagner et al., 2016). In addition, it has been shown that being supportive of a child is conducive to stronger working memory (Vandenbroucke, Spilt, Verschueren & Baeyens, 2017). Exclusive support is typical of an authoritative parenting style. Another study suggested that disadvantaged children had better executive functioning when they had a responsive parent (Merz, Landry, Montry, & Williams, 2016). According to Merz et. al. (2016) and Wagner et. al (2016), a responsive parenting style, characteristic of authoritative parenting style, will have a greater positive effect on memory than authoritarian and permissive parenting. Executive function develops rapidly in preschoolers, specifically in areas such as working memory and mental flexibility (Anderson et. al., 2012). Thus, investigating the early development of memory, in accordance with parenting styles, will better allow the field to evaluate parenting methods to promote children's future wellbeing. Preschool-aged children's memory will be assessed at the beginning and end of the 12-week study. A neuropsychological assessment (NEPSY-II) will be used to test both narrative memory and memory for designs while the Missing Scan Task will be used to test working memory. Parents will complete the parenting styles and dimensions questionnaire (PSDQ) to identify which parenting style they use. We hypothesize that authoritative parenting will yield the highest memory scores, while permissive and authoritarian parenting will yield lower memory scores. We also hypothesize that the memory scores will remain the same throughout the study. By better understanding the relationship between parenting styles and memory in preschoolers, the field can be better equipped to educate parents, teachers, and schools on the most conducive way to strengthen children's memory and executive functioning.

## Relationship between Activity Level and Memory in Preschool-Aged Children

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**Bradley Dixon**  
**Alyssa Goodwin**  
**Darby Baird**  
**Elizabeth Vizcarra**  
**Erin Freiburger**  
**Grace Ditzenberger**  
**Lakna Jayasinghe**  
**Lauren Evert**  
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*This research was supported  
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A vast amount of research has been done on the development of cognition, however less research has been conducted on the effects of regular exercise and early developing cognitive functions. Past research has found that engaging in more cardiorespiratory physical activity is associated with higher functioning working memory in preadolescent children (Kamijo et al., 2011). Furthermore, another study found that more fit children (aged 9-10) had both larger hippocampal volume and better relational memory (Chaddock et al., 2010). Memory is an essential aspect of healthy relationships, academic excellence, and everyday functionality. Since past research has shown a relationship between exercise and memory in middle childhood-aged children it is imperative to the field to understand early childhood developmental mechanisms of memory and what variables, such as exercise, impact such an essential aspect of development. We will examine the correlation between the preschooler's activity level and their memory task performance. Preschoolers were administered memory tasks and their body mass index (BMI) was recorded. We utilized the Missing Scan Task (MST), a developmental neuropsychological assessment (NEPSY-II) memory for design test, and NEPSY-II narrative memory test to assess the children's memory. To track activity levels we placed a Fitbit® on the child's ankle for 12 weeks. The Fitbit® gave us the ability to track the number of steps taken each day, calories burned, and how many minutes were spent doing fat-burning exercise. We will employ a correlational data analysis using Pearson's r to evaluate the data we receive from the memory tests and Fitbit®. We hypothesize a positive correlation between activity and memory. This hypothesis is based upon the positive physiological effects exercise has on the brain. The current study will help to further the field on the understanding of the effects that exercise and activity have on young, developing minds.

## The Effect of Religion and Spirituality on Physical Activity

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**Selena Quintanilla**  
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Americans struggle to get a sufficient amount of physical activity which can cause a wide array of negative health outcomes (Brownson, Boehmer & Luke, 2005). Research has shown that religiousness and spirituality are positively associated with physical activity (e.g., Strawbridge et al., 2001). In an effort to identify variables that foster better health outcomes, we analyzed the effects of religiousness and spirituality on physical activity. To investigate this, we conducted a seven-day daily diary study. The study procedure was approved by the Human Subjects Review Board. The participants were 150 undergraduate students enrolled in an introductory psychology class and they received course credit for participating. The daily diary method tracked the participants' experiences of religiousness and spirituality and their health behaviors, including physical activity, over seven days. First, participants completed a pre-survey to assess demographic and background information on pre-existing health behaviors, including physical activity. We hypothesized that those who engaged in more religiousness and spirituality behaviors, those who have more religious and spiritual experiences, and those with a general inclination to engage in and prioritize religiousness and spirituality in their lives (trait religiousness and spirituality) would engage in more physical activity. The results revealed that there were no associations between religious behaviors, experiences, or trait religiousness with physical activity. The results did not support our hypotheses. Because physical activity is integral to a person's well-being, any mechanisms that encourage it are important in improving well-being within the general population.

## The Mental Health of Minority Students at Predominantly White Institutions

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**Sutherland-Smith**

Mentor:

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Mental health is important at every stage of life, especially the college years during emerging adulthood. Students cannot truly be healthy without proper mental health. However, there has been little exploration of mental health provisions for minority students at Predominantly White Institutions (PWI) in relation to identity formation. Mental health reflects emotional, psychological, and social well-being. It affects how we think, feel, and act. Minority students can experience depression, posttraumatic stress disorder, academic stress, financial strains, and racial microaggressions (Levin, 2017). It can be crucial for students of color to access proper health care provisions. However, what happens to identity formation when inadequate services are provided for students? Environment is a key component in the mental health equation. Minority students at PWI can experience additional environmental stressors such as discrimination and proving belonging (Maramba & Velasquez, 2012). Although students of color may experience the same overwhelming feelings as white students, they are less likely to express concern or seek treatment (Williams, 2011). Without proper treatment, mental health can worsen, making everyday life grueling. We propose that the lack of, or perceived lack of, cultural competence and health care provision has a negative impact on ethnic identity formation and the utilization of mental health services. This study employs a Qualtrics survey assessing ethnic identity and mental health. Symptoms of mental health commonly associated with minorities at PWI (e.g., anxiety, depression) are assessed using the Patient Health Questionnaire (PHQ-SADS) and Keyes Flourishing Scale. Identity formation and acculturation are assessed using the Vancouver Index of Acculturation. Perceived social support is assessed using the Multidimensional Scale of Perceived Social Support (MSPSS). Additional survey items assess demographic indicators, coping strategies, relationship with God, campus climate, and the use and perception of mental health support on campus.

## The Effect of Physical Activity on Sleep Habits and Sleep Quality in Preschool-Aged Children

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**Mary-Kate Szuma**  
**Carolina Marshall**  
**Bradley Dixon**  
**Alyssa Goodwin**  
**Darby Baird**  
**Elizabeth Vizcarra**  
**Erin Frieburger**  
**Grace Ditzenberger**  
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*This research was supported  
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Sleep is positively associated with physical activity in adults and adolescents. However, previous research remains inconclusive regarding the association between sleep and physical activity in preschoolers. Good quality sleep is especially important for preschoolers, as continued body growth and development, tissue repair, and memory processes occur during this critical period. Despite this knowledge of the importance of sleep, preschoolers are getting less sleep than the recommended 11-12 hours per day, and more than two-thirds of children experience frequent sleep problems (National Sleep Foundation, 2004). Therefore, the purpose of this study is to examine the effect of physical activity on sleep quality and sleep habits in area preschoolers. In the current study, we recruited preschool-aged participants from two different area preschools. Three memory tests, as well as a sleep hygiene scale and a socioemotional assessment were initially administered for each child. Measurements of each child's height and weight were also taken, and were further used to calculate BMI. Fitbit devices were placed on each child's ankle for twelve weeks. We hypothesize that children who are more physically active will exhibit better sleep quality, an earlier bedtime, and a later wake time than children who are less physically active. We also hypothesize that children who are most active in the evening will exhibit poorer sleep quality than children who are most active in the morning or afternoon. The results of this study will provide greater knowledge regarding the association between sleep and physical activity that may be useful in implementing better education for parents and children geared toward improving sleep.

## How Do Guatemalan Adolescents Help Each Other?: Within-Country Diversity in Prosocial Behavior and Empathy

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**Nate Silagi**

Mentor:

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*Psychology*

Empathy and prosocial behavior shape adolescents' daily interactions with friends and family, and those behaviors may vary by socioeconomic status. The considerable economic inequality and within-country diversity in socioeconomic status in Guatemala make it an ideal context for addressing this issue. This mixed-methods study was conducted in two schools ( $N = 122$ ): a bilingual school that served students with greater economic resources ( $n = 66$ ) and a school that served students with few economic resources ( $n = 56$ ). We hypothesized that students with fewer resources would report greater empathy. Participants indicated whether they had 14 different possessions or household amenities in their homes. Adolescents in the low resource school averaged 4.82 items/amenities compared to their peers in the high resource school who averaged an 11.97. As part of a larger study, adolescents completed the Basic Empathy Scale and answered questions about personal experiences with prosocial behavior. A one-way Analysis of Variance (ANOVA) revealed a significant difference between schools with respect to empathy. More specifically, students with fewer economic resources reported greater empathy compared to their peers with more resources. An Analysis of Covariance (ANCOVA) suggested that when the mean number of household possessions/amenities was entered as a covariate, the difference in empathy scores disappeared indicating that economic resources are related to empathy. The qualitative findings were coded using thematic analysis and revealed that students from both schools were ultimately similar in the way they gave and received help. One main difference was that students with greater resources more commonly mentioned finances both in the ways they helped or were helped. Perhaps they simply have access to more economic resources and were able to help in that way. Implications for peer relationships and the importance of acknowledging within-country diversity in adolescents' lives will be discussed.

## Social Inclusion and Disability in the US and China: An International Context for Experiential Learning

**Kylie DeKryger**  
**Abigail Duran**  
**Maria G. Garcia Reyes**  
**Gabrielle Werner**

Mentor:

Dr. Dennis Feaster  
*Sociology & Social Work*

*This project was supported by the ASIANetwork and the Freeman Foundation through the Student-Faculty Fellows Program.*

Children with disabilities are a highly vulnerable group around the world, including in China (Cheung, 2013). However, China's context differs in two notable ways: population size and lack of systematic means of delivering community-based services for people with disabilities (Fisher, Li, and Fan, 2012; UNICEF-EAPRO, 2012). This project focused on the study of community-based services in China and their role in the continuum of care for persons with disabilities. In addition, students and faculty participated in experiential learning and professional development through engagement with non-governmental organizations that focus on this population in the cities of Beijing, Xian, Zhengzhou, and Hong Kong. Students also participated in a range of professional activities, including providing training for parents who have children with disabilities, participating in home visiting sessions, and working closely with local service providers on self-identified areas of interest and need.

## Exploring the Attitudes of the Hope Campus Community towards the Ready for Life Program

**Katherine Veldink**  
**Madelyn Mikitka**  
**Elizabeth Lilley**  
**Jordon Lambert**

Mentor:

Dr. Dennis Feaster  
*Sociology & Social Work*  
Professor Nancy Cook  
*Education*

Exploring the attitudes of the Hope College campus community towards the Ready for Life Program was a topic first researched for a fall Genius Hour Showcase, as social inclusion is a primary area of interest for this researcher and her team. Ready for Life is a program that provides post-secondary educational experiences for college-aged individuals diagnosed with cognitive, learning, or social disabilities. Instructors at Ready For Life assist each student in daily instruction and support, and partners with Hope College professors to adapt the academic materials from the courses each student is enrolled in. As a partner with Hope College, Ready for Life students have access to many of the things that Hope students enjoy. However, there are also significant barriers to full inclusion on Hope's campus that could be resolved if Ready for Life was a Hope College program. The research question that was developed was, "What are the attitudes of Hope College stakeholders about students with disabilities from the Ready for Life program?" A survey was designed and then distributed during the lunch hour in Phelps Hall. 52 surveys were provided to a convenience sample of students, staff, and guests. Questions were asked about attitudes toward the Ready for Life program, and their opinions about whether people with special needs should attend college. Following the distribution of the surveys, data were collected and organized by survey question. The initial findings were positive, suggesting that the Hope community would be open to more fully including Ready for Life students into campus life and academics.

- Ahlgrim, Grace C. 55  
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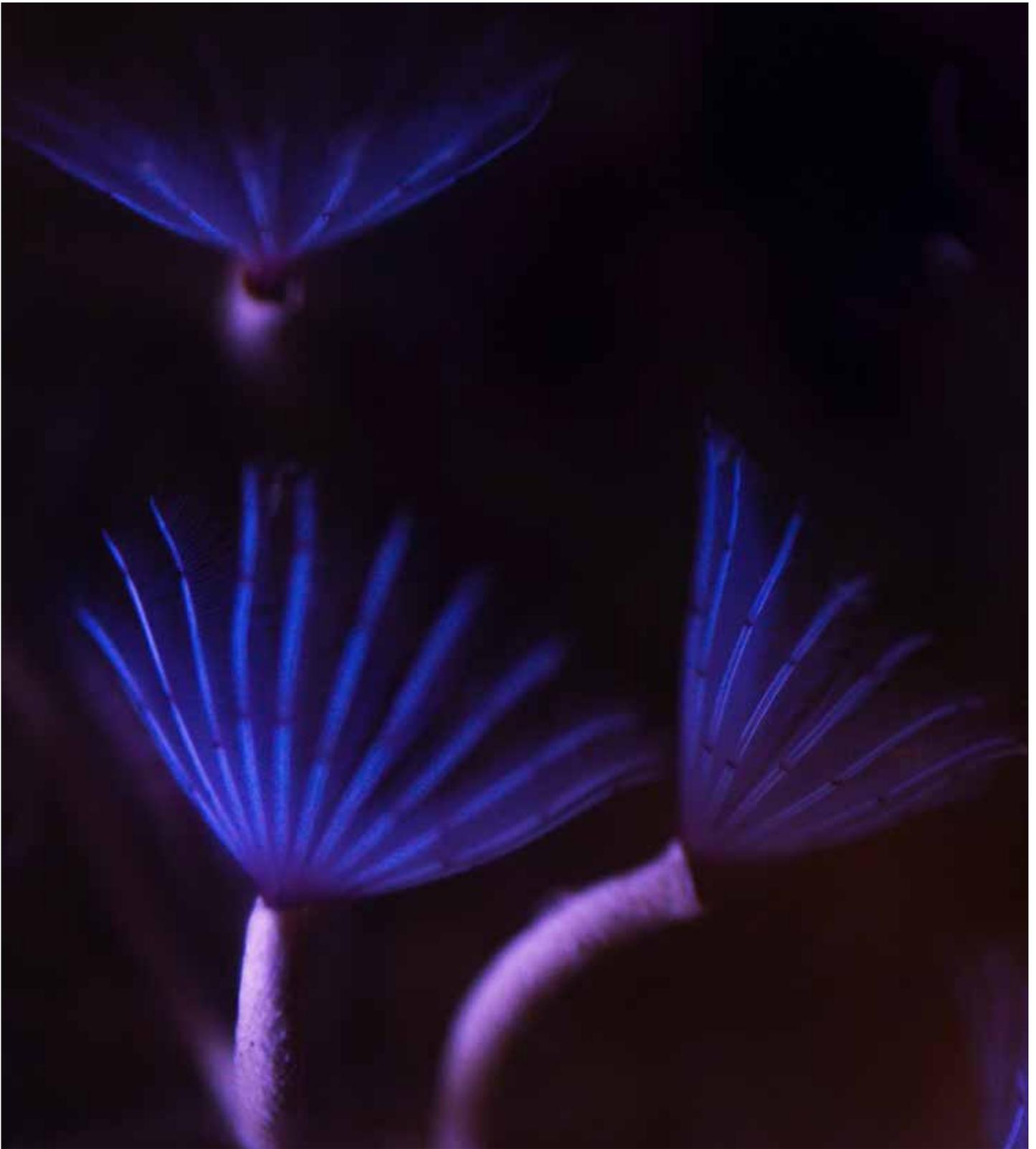
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