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Hope College Abstracts: 14th Annual Celebration of Undergraduate Research and Creative Performance

Hope College

ABSTRACTS

Hope College

14th Annual Celebration of Undergraduate Research & Creative Performance

2014-2015

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WELCOME FROM THE PROVOST

April 30, 2015

DEAR FRIENDS,

We were pleased to welcome more than 370 students and many, many guests to the Fourteenth Annual Celebration of Undergraduate Research and Creative Performance at Hope College. Each year I look forward to this event because it gives our whole campus and community the opportunity to celebrate the accomplishments of students who have completed scholarly and creative projects under the careful mentoring of our exceptional faculty. As I stopped to talk with students about their projects, I was struck by the professionalism of the posters and the poise and preparation of the students.

The wide representation of presentations from departments and programs all across the curriculum speaks to the commitment of all of our faculty to providing students with the opportunity to complete an ambitious project under their guidance and mentorship. We are glad the Celebration continues to grow in numbers of students and numbers of projects and we hope that even more students experience the excitement and challenge of a scholarly project and the culmination of that project through a presentation at the Celebration.

This book of abstracts is an important record of the creative and rigorous projects that were carried out during 2014 and 2015. Each abstract describes a collaborative project between the present and the next generation of scholars—a collaborative effort that brings the disciplines to life and inspires curiosity and reflection that goes well beyond the confines of a typical classroom. For each student, staff member and faculty mentor who contributed to work described in this impressive book, please accept my sincere congratulations and thanks! Each of you testify to the very best qualities of a Hope education and we are proud of all that you have accomplished.

If you are interested in knowing more about the distinctive qualities of a Hope College education, including learning by doing, please visit www.hope.edu. Thank you for your participation and support for the Celebration.

Sincerely,

Richard Ray

Richard Ray
Provost

STUDENT RESEARCHERS

STUDENT RESEARCHERS

STUDENT RESEARCHERS

COVER AND HEADER ART

Image by **Stephanie Simko** ('17). The photograph was taken of flame testing compounds with a Bunsen burner. Different compounds emit various colors when burned in the flame. This particular photograph was taken of a mix of salts, including those comprised of strontium, copper, potassium, and lithium.

Image by **Xiaoyo Fang** ('17). The photograph was taken during Holland's Downtown Christmas parade at night. The camera I used was Canon EOS 7D; focal length was 50/1; aperture was 18/10; time of exposure was 1/80; light sensitivity was 640.

ARTS & HUMANITIES
ART AND ART HISTORY

The Harry Brorby Project

Amanda Bennick, Brant Biba, Rachael Corey, Monica Dwyer, Austin Garcia, Stephanie Harron, Mason Hunt, Nancy Laning, Erin Schregardus, Amy Van Dommelen and Sai Wang
Mentor: Dr. Heidi Kraus
Department of Art and Art History

In 2014, sixteen boxes of artist Harry Brorby's personal documents, drawings, photographs, and ephemera were donated to The De Pree Gallery. A respected West Michigan-based painter, printmaker, and sculptor in the 1960s and 70s (whose work is part of the permanent collections of the Museum of Modern Art in New York City and Walker Art Center in Minneapolis to name a few), this project seeks to understand Brorby's prolific career within the context of Contemporary Art and, moreover, the notion of artistic legacy and collective cultural memory. To this end, students have been divided into five project teams, each focusing on a specific aspect of the archives and its preservation: website creation and content management (Amy Van Dommelen, project manager), organization of archival material (Stephanie Harron, project manager), digitization of archival material (Brant Biba, project manager), contact management and historical reconstruction (Nancy Laning, project manager), and provenance reconstruction (Erin Schregardus, project manager). In addition to this group component, each student is concentrating on a specific aspect of Brorby's archives that peaks their curiosity—something they would like to personally explore further. Individual research papers and on-line digital portfolios will serve as measurable outcomes for the course.

Colin Rensch, Hope Hancock and Cullen Smith, all Mellon Scholars, presenting at the Celebration, 2015.

I Believe Aang Can Save the World: *Avatar: The Last Airbender*'s Place in the "Literary" Canon

Hannah Gingrich
Mentor: Dr. Curtis Gruenler
Department of English

In 2005, children's television network Nickelodeon first aired a new show entitled *Avatar: The Last Airbender* (ATLA). In its three-season run, it won the hearts of children, adults, and critics alike. Although clearly a popular show, we must ask of it the question we frequently ask of popular books. Can we consider it *literature*? To answer this question, we might look to see how the show holds up when compared to three emerging spheres of literary criticism: feminism, disability studies, and ecocriticism. If we look at what critics in these disciplines have generally said about how true literature approaches their respective social issue, we can easily say that ATLA meets and surpasses their expectations. ATLA raises awareness about emerging cultural concerns by presenting the show's ideal society as an inherent part of its world, suggesting change in understated yet visible ways. As a result of its progressive host network, ATLA takes a groundbreaking approach in exploring these issues, but subtly enacts it so that the audience sees this attention, but does not feel pressured to comply.

Objects of Desire: Mimetic Theory in Middle-earth

Anna Goodling
Mentor: Dr. Curtis Gruenler
Department of English

Twentieth century author J. R. R. Tolkien permanently impacted the world of fantasy with his work in Middle-earth. Countless aspects of his legendarium have been examined by readers, scholars, and critics, who view them through widely-varying lenses of literary theory and criticism in an attempt to interpret the ideas central to Tolkien's universe. However, few scholars have explored the relationship between Tolkien's works and literary theorist René Girard's concepts of mimetic desire and scapegoating, leaving this relatively untraversed field ripe for study. Girard's mimetic theory offers insight into Tolkien's understanding and portrayal of power by providing a method of interpreting his use of objects of power to demonstrate the corruptive nature of such items and the rivalry they incite. This research examines Girard's theories, applying his ideas of triangular, imitative desire for an Object to the texts of *The Hobbit* and *The Lord of the Rings*.

The Roots of Greatness: What Does the Relationship between Henry and Hal Reveal about Henry V's Rule?

Robert Lampen
Mentor: Professor John Cox
Department of English

One of Shakespeare's most commendable qualities as a playwright is the ability to create dynamic characters. These characters appear in their full nuanced glory through their relationships with other characters in the plays. This research focuses on the relationship between Henry IV and his son Hal throughout the Lancastrian Tetralogy — Shakespeare's four history plays commencing with *The Tragedy of Richard II* and closing with *Henry V*. The purpose of this paper is to use this relationship to shed light on Hal's character after he begins to rule as Henry V. In this research, similarities between the Henry IV and Hal are explored through categories such as the similarities in the two characters' language and Hal's mimicking of Henry IV's rule. Whether through implicit or explicit words and actions, Henry IV influences his son, molding him to be the next King of England. This research also examines the important differences between Henry IV and Hal and describes how these key differences make Hal a stronger ruler. Henry IV's misunderstanding of Hal's political tactics and Hal's willingness to go further than his father in his political trickery are both examples of differences that cause chasms between the two characters while also illustrating the complexities of Hal.

HISTORY

Faith and Humanitarian Aid in Wartime China, 1937-1941

Claire Barrett
Mentors: Dr. Marc Baer, Dr. Jonathan Hagood, and Dr. Gloria Tseng
Department of History

This research was supported by a Pagenkopf History Research Scholarship.

The outbreak of the Second Sino-Japanese War (1937-1945) and World War II (1939-1945) created one of the largest refugee populations of the twentieth century. This research demonstrates how the Reformed Church in America was more effective in administering aid to the Chinese population than other relief organizations and the Chinese government in particular. With China already weakened due to the fractures between the Communist Party in China and the Chinese Nationalist Party, the ruling CNP could not effectively distribute aid to their citizens. On the islands of Kulangsu and Amoy, the missionaries provided an infrastructure on the ground that assisted with medical aid, food, housing, schooling and spiritual guidance, as well as acting as a historical witness to war crimes committed by the Japanese. The missionaries' practical demonstration of the word of God would eventually determine the modern, twenty-first century view of evangelists in China. The Chinese perspective on the missionaries changed throughout the twentieth century. However, the twenty-first century narrative in China is that without the missionaries and their work, thousands of Chinese refugees would have perished. That is the enduring reality of the story.

Herbert Butterfield and the History of Science

Ian Bussan
Mentor: Dr. Marc Baer
Department of History

In terms of traditional historiography, the history of science is a relatively new field of historical analysis. Though he was certainly not the first person to promote the discipline as worthy of interest in and of itself, British historian Herbert Butterfield can be considered a major popularizer of the history of science as an integral part of world, and especially modern, history. Butterfield, a respected historian who also specialized in diplomatic history, helped create the study as we know it today, in its "great men" formula that has been the basis for narrative accounts of science's historical activities. While earlier practitioners focused on methodological practices or the national grandeur of a country's famous scientists, it was Butterfield who created the field as an integral sub-category of modern world history. This research explored Butterfield's predecessors, his writings on the history of science, and his subsequent promotion of and influence on the history of science.

Nursing Body, Mind, and Country: Missionary Nurses and the Hope Hospital School of Nursing in Xiamen, China

Katelyn Dickerson
Mentor: Dr. Gloria Tseng
Department of History

This research was supported by a Jacob E. Nyenhuis Student/Faculty Collaborative Research Grant.

This paper is a case study based on the notes, periodicals, and letters of Western missionaries and Chinese Christians affiliated with the Reformed Church in America, found at the Joint Archives of Holland. These sources reveal that the relationship between missionaries and the local Chinese was much more nuanced than the stereotypical images of missionary "imperialists." This paper seeks to answer the question: What role did missionary nurses play in the lives of their Chinese students during the early twentieth century? Missionary nurses in China during the early twentieth century were essential to the development of modern nursing in China and the promotion of nontraditional career paths for Chinese women. Nurses associated with the Reformed Church in America, such as Jeannette Veldman, Jean Nienhuis, and Jessie Platz, recognized the need for nursing in China and attempted to fill it by creating a nursing school. The school was affiliated with the R.C.A. mission, which encompassed the Hope and Wilhelmina Hospital in Xiamen, China. The missionary nurses admitted young Chinese women who had an interest in a nontraditional path. By educating local women in the science of nursing, the missionary nurses were giving their students an opportunity not available to women in traditional Chinese society. Western nurses encouraged Chinese nursing students to overcome traditional

barriers in the areas of dress, gender relations, and women's role in society. Through the unique relationship that they formed with the young women, missionary nurses were able to aid their students in pushing these boundaries. The cross-cultural friendships formed were based on mutual trust and respect, allowing the missionaries to play a significant role in the lives of their students. Thus, contrary to popular belief, missionaries were forming meaningful relationships with the local people, which were built upon the pillars of faith, friendship, and professionalism.

The Grand Facade: A Comparative Study of Paris and Shanghai in the Late Nineteenth and Early Twentieth Centuries

Katelyn Dickerson, Brandon Verna, and Katelyn Kiner
Mentor: Dr. Gloria Tseng
Department of History

During the late nineteenth and early twentieth centuries the world as a whole was facing vast social, political, and economic changes. In a case study of two international cities, Paris and Shanghai, the dramatic shifts are overwhelmingly evident. Through the use of photographs, paintings, and other media our team developed an exhibit exploring the similarities and differences of these two cities. As the cities progressed into the twentieth century it was obvious that they shared common characteristics. On the surface, both cities existed under glorious facades that masked the harsh realities beneath the surface. The prosperous Bund in Shanghai and Haussmannian Paris masked the tumultuous political landscapes and social conflicts in the cities. In Shanghai, many of the local Chinese lived in poverty scraping out a living as rickshaw pullers or prostitutes. Likewise, Paris was overwhelmed by political tensions as Frenchmen vacillated between monarchies and republics. Though seemingly different at first glance, the international crossroads of Paris and Shanghai contained unseen turmoil beneath their visage.

Indian Novels: Colonial and Post-Colonial History

Christopher Gager, Angelica Rodriguez, and Christian Wierda
Mentor: Dr. Marc Baer
Department of History

Through the study of historical fiction, valuable perspectives on historical events can be gained. Unlike history textbooks, novels probe deeper and more personally into significant events and their impact on people and nations. Postcolonial Indian novels show the power of fiction to inform the study of history by providing insight into a watershed period of South Asian history. *Train to Pakistan* by Khushwat Singh, tells the story of a fictional town on the Border of India and Pakistan following the 1947 Partition of India. Using the tool of fictional prose, Singh shows the complex religious and social ramifications of the political decision to split Pakistan and India into separate countries following India's independence. *The Man-Eater of Malgudi,* by R.K. Narayan, provides an analysis of how Indian lifestyles were impacted and ultimately altered by British colonialism in the region. The struggles of building a modern state that retained Indian culture are explored by individuals, allowing the reader to experience a deeper understanding of what the people of India experienced in the post-colonial era. *Midnight's Children* by Salman Rushdie is a metaphysical novel set mostly in Bombay and the Kashmir region following the independence of India in 1947. It centers on the struggles of constructing a national identity after colonialism and the difficulties faced by the Indian people and the government given the Partition of India. These three works provide important insights into the period and setting of postcolonial India and in doing so reveal the novel as an important source of historical understanding. By reading and analyzing these novels both the historian and layman can gain valuable insight into the human reality of a people, time, and place.

HISTORY

The Man of Two Worlds: Léopold Sédar Senghor

Katelyn Kiner
Mentor: Dr. Lauren Janes
Department of History

Léopold Sédar Senghor grew up in a relatively calm colonial Africa, came of age in the excitement of World War Two and as a man helped create a sovereign Senegal. This research looks at forces of influence from his boyhood onward, to see how they shaped both his poetry and politics. The time Senghor spent learning and working in France is particularly highlighted, as it was a time of immense cultural growth for Senghor. The most influential parts of his time in France came from his involvement in and creation of the Négritude movement. This literary and idealogical movement inspired the writing of his poetry and led to his more moderate socialism, once he was involved in politics. This research also takes a closer look at how in his poetry, Senghor wrestled with reconciling African history to French culture and how that effected his foreign policy. In the end the study of his poems and politics exposes Senghor as a man from opposing cultures trying to find harmony between them.

From Slaves to Rulers: The Great Divide between Americo-Liberians and West Africans in 1830s Liberia

Kortny Milhollin
Mentor: Dr. Lauren Janes
Department of History

This paper will explain the social divide that occurred during the early establishment of Liberia in the 1830s, mainly as a result of the ideology of the Americo-Liberian settlers. I analyze the letters of an Americo-Liberian family, the Skipwiths, which reveal the establishment of a social hierarchy in Liberia in the mid-nineteenth century. Because these Americo-Liberians had known only the political and social structure of the United States, the area they settled seemed to model the antebellum South in the sense that a great cultural divide was created between the Americo-Liberians and the native West Africans, just as there was a divide between the whites and the blacks in America. The free blacks who came to Liberia from America in the early-to-mid nineteenth century did everything they could to distance themselves culturally from the native West Africans. This cultural distance was accomplished by Americo-Liberians keeping their American manners and customs in Africa and importing American and European goods for their use, while refusing to assimilate with the native West Africans. This is especially important in understanding how the Americo-Liberians thought themselves superior to the native West Africans, which ultimately created a social and cultural divide between the two groups.

Diamonds are Africa's Worst Enemy

Meredith Morse
Mentor: Dr. Lauren Janes
Department of History

During the birth of the diamond mining industry in South Africa, both black and white laborers in the Kimberly mines had bargaining power to increase wages and improve mine conditions. However, Cecil Rhodes' consolidation of the diamond mining industry eliminated the power of these laborers, bringing the mines under the De Beers diamond company name. Aiding this consolidation of power was Cecil Rhodes' political power which put into place labor laws that took away the laborers' ability to fight for better working conditions. My analysis of the 19th century Kimberly diamond mining industry in South Africa and of the amalgamation of the Kimberley and De Beers mines reveals further political, social, and economic issues that originated at the mines and spread throughout Africa during the late 19th century. As seen through legislation surrounding the mines and personal accounts of visitors to the mines, the abuse and harassment of the black laborers of the South African diamond mines comes to light. The master-servant relationship between whites and blacks pushed its way into laws that were supposed to be "color-blind," but clearly enforced harsh restrictions on every aspect of life, specifically for the black laborers. However, the indigenous population of laborers had the ability to fight against such

legislation by the simple act of leaving in search of a better employer. This small but powerful ability was taken away when Rhodes held his diamond monopoly. The laborer was further suppressed into terrible working conditions as the mines were brought under one man's power.

Not Just a Movie

Lindsey Mudge, Leland Cook, and Thomas Zahari
Mentor: Dr. Marc Baer
Department of History

With the release of *Selma,* there has been debate over how historically accurate film producers' movies truly are. The purpose of this study is to analyze if historians should trust history to film producers in the movies they create. This study will examine three movies, *Gandhi*, *Home and the World*, and *The Battle of Algiers* by analyzing their historical validity. It will also examine what is historically inaccurate pertaining to the movies and the motives behind the historical inaccuracies. This study will examine the French, British, Algerian, and Indian views on the issues portrayed in these movies and how they interact based on the region and timeframe of the movies' production and subjects.

The Politicization of Japanese Immigration Exclusion in Early-Twentieth Century Oregon

Alexandra Piper
Mentor: Dr. Jeanne Petit
Department of History

Anti-Japanese hysteria was growing in the early twentieth century America. This poster specifically examines how anti-Japanese sentiment grew in Oregon compared to other states, like California. The government and people of Oregon were originally more tolerant of Japanese immigration while California always had a stronger, wholly nativist response to the issue. As time progressed, Oregon as a whole became nativist. I examine this progression using a variety of sources including a government commissioned report of the Japanese situation in the state, and speeches from two governors who served from 1919 to 1927. The report and the speeches of the first governor, Ben Olcott, show how Oregon attempted to remain neutral on the issue. When Walter Pierce challenged Olcott for re-election in 1922, he made the restriction of Japanese immigration a central issue in his campaign. As governor, Pierce encouraged anti-Japanese immigration restriction, and his term produced considerable legislature against the Japanese. The shift from a neutral governor to a nativist governor shows how the hysteria grew in states, eventually reaching its height with the Johnson-Reid Act. This act singled out Asian immigrants and banned the entry of aliens.

Stealing Home: Jackie Robinson, the *Pittsburgh Courier*, and Integration through Baseball

Miriam Roth
Mentor: Dr. Jeanne Petit
Department of History

This project traces the story of Jackie Robinson's first two years in professional baseball, from 1945 to 1947, as told by the activist paper the *Pittsburgh Courier*. The *Courier*, the largest weekly paper in America at the time with a primarily African American readership, had a history of campaigning for the integration of baseball, and forged a direct relationship with Robinson through the initiative of one of its editors, Wendell Smith. Over the course of Robinson's quest for the major leagues, Smith and other writers for the *Courier*, including Robinson himself, utilized rhetoric that connected Robinson's actions on the diamond to the greater fight for racial equality. Based primarily on research of the *Courier*'s sports section, this project analyzes how the paper used gameplay as a crucial tool in the paper's civil rights activism, fighting for integration in baseball and beyond.

HISTORY

Slavery after Liberation: the Development of Child Trafficking in West Africa

Holly Thompson
Mentor: Dr. Lauren Janes
Department of History

Slavery may seem to have been abolished in the world, yet is still a persistent trade that plagues modern society. West Africa has specifically had issues with the trafficking of children. There have been recent cases in Togo, Nigeria, and Benin. Furthermore, the chocolate plantations in the Ivory Coast have been proven to use child slaves, and child soldiers were very common during the violent conflict in Sierra Leone from 1991 until 2002. This research examines how the current issue of child trafficking and slavery in West Africa began and developed. This paper demonstrates that the current trade can be traced back to the colonial economy, the evolution of the slave trade, and cultural expectations. These roots have cultivated a demand for and dependence on cheap labor. While the laws, the perpetrators, and the victims of modern slavery have changed, the structures have remained very similar. In the same way, while the identity of abolitionists has changed, the style of advocating for abolition has remained similar.

Calls to Arms: Liberty in Confederate War Music

Jonathan Tilden
Mentor: Dr. Jeanne Petit
History Department

Music is one of the most striking cultural products that can be examined. The music of the Civil War is no exception and Confederate war music helps the modern understand the motivation to fight for Johnny Reb. When examining Confederate war music, it becomes clear that the motif of liberty was paramount in the southern understanding of the war. This lay at the heart of their rationalization for succession. Out of this came a myriad of Southern comparisons between 1776 and 1861. Revolutionary imagery and language permeated a number of songs, such as "The Right Above the Wrong," and "Seventy-Six and Sixty-One." Liberty was one of the most potent concepts in Confederate war music and from this came an extremely fascinating subgenre of wartime music that sought to portray the Confederacy as the rightful heirs of the founding fathers.

Mellon Scholars and History majors at the Celebration, 2015

MODERN & CLASSICAL LANGUAGES

La Paysanne et L'héroïne: The Life and Mission of Joan of Arc in the Social Context of the Middle Ages

Alexandria Barbu
Mentor: Dr. Brigitte Hamon-Porter
Department of Modern and Classical Languages

Joan of Arc (Jeanne d'Arc) is undoubtedly one of the most notable figures in French history. That a young peasant girl could rise to a position of military power and aid in bringing about the end of the Hundred Years' War is nothing short of remarkable, and so Joan's story has fascinated writers and historians for centuries. However, too often Joan of Arc has been viewed from modern perspectives thus leading to a misinterpretation of who she was and what she did. This research attempts to view the life and mission of Joan through the lens of the cultural context in which she lived. It opens with an examination of the nature of social, religious, and gender structures in France during the 1400s. This is followed by an analysis of how Joan of Arc completed her self-proclaimed mission to save France from British occupation both by working with and defying the social structures of the Middle Ages. After briefly addressing the reputation that Joan has gained as a visionary, it concludes that she won that status not only for her daring and revolutionary actions but also because of the ways that she was willing to accept the nature of the society she was born into and work with its constructs.

Jean Moulin and the French Resistance during World War II

Alexandra DeJongh
Mentor: Dr. Brigitte Hamon-Porter
Department of Modern and Classical Languages

Known today as one of the most prominent leaders of the French Resistance during World War II, Jean Moulin was given by General Charles de Gaulle the seemingly impossible task of unifying the different movements of the Resistance during the war. Through countless difficulties, he succeeded in forming one solid resistance that included both right-winged Royalists and left-winged Socialists. This research analyzes the reasons for which the French Resistance began, the impact Jean Moulin had on the Resistance, and finally his betrayal to the Gestapo on the 21st of June, 1943.

The Magic of Words: The Role of Griots in West African Society and Film

Dorothy Dickinson
Mentor: Professor Brandon Guernsey
Department of Modern and Classical Languages

When asked about their relationship to the traditional West African storytellers and singers called griots, African Hip-hop artists have responded negatively, describing griots as parasites and sycophants. African filmmakers like Ousmane Sembène, on the other hand, have compared themselves favorably to griots, describing griots as artists and preservers of culture. This presentation explores both the disconnect between the two descriptions and the resemblance between griots and filmmakers. After examining second-hand accounts, as well as looking into the interviews and films of African filmmakers, it becomes clear that the position of the griot in West African society is complex. It may be a familial occupation with a long history, but it is still a job that relies on the donations of patrons. This reliance can make griots resemble sycophants. While they may show a keen artistry, griots must sing the praises of their patrons. Filmmakers, despite sharing artistic and traditional goals with the griot, have much more freedom. Perhaps, then, filmmakers should not only continue to portray griots in their films, but should employ them as well. Bringing more griots into the African film world will not only help to resolve their financial difficulties and provide them with a platform for their stories and songs, but will also allow West African filmmakers to stay connected to their roots even as they continue to explore what it means to be filming in Africa today.

MODERN & CLASSICAL LANGUAGES

Imperial Acculturation: The Lucianic Corpus as a Study in Satire, *Mimesis*, and Cultural Identity

James Engels
Mentor: Dr. Stephen Maiullo
Department of Modern and Classical Languages

Lucian of Samosata (c.125 – c.180) is one of the most celebrated authors of the Second Sophistic and Imperial Greek literature. Since his death, he has achieved notoriety and praise for his ability to combine genres coherently and for his wit, caustic humor, and literary prowess. The hallmark of his genius, however, was his use of *mimesis* and the traditions of the Epic, Herodotean history, Platonic dialogue, and Menippean satire to sharply critique the Greek and Roman society of the Second Sophistic, in particular, his tendency to use source material in lampooning source material in an act of *meta-mimesis*. I will examine his motivation, influences, and literary personae through his *mimesis* of the traditions in history, comedy, and epic poetry, and attempt to present a coherent analysis of Lucian within his social and literary contexts.

Aux Yeux De…: A Study of the Perceptions of the Mali Empire

Maria Gowon
Mentor: Professor Brandon Guernsey
Department of Modern and Classical Languages

"Aux Yeux De…" unearths the perceptions of the Mali Empire that dominated West Africa from 1250AD – 1650AD. The project follows the travels of Ibn Batouta, a Berber Islamic lawyer nicknamed the "Marco-Polo of the East," as he journeys through the Empire during the 1350s. We revisit the Empire once more in the mid-1500s through the travels of André Alvarez d'Almada, the son of a Portuguese colonizer of the Cape Verde Islands. The project explores how Batouta and d'Almada simultaneously represent and form Arab and European perceptions of the Mali Empire through their travels and writings.

Les Femmes Blanches et Les Femmes Noires dans les Cinémas Américains et Africains | White Women and Black Women in American and African Films

Rachael Kabagabu
Mentor: Professor Brandon Guernsey
Department of Modern and Classical Languages

At the time of the creation of the American movie industry, the world was very different from the one we know today. Black citizens, though freed from slavery, were subject to legal discrimination, and women were treated as second-class citizens. At the same time, filmmakers were discovering the influence of cinema on society. The oppressive societal norms began to make their way onto the silver screen. The white, male filmmakers portrayed African-Americans as inhumane, savage beasts. African-American women received the most degradation; firstly for their race, and secondly for their gender. On the contrary, the African film industry portrayed African-Americans, men and women, as capable and complex human beings. This research takes a close look at the origins of American cinema and its representation of specific female characters of Rosie and Jane from the films *The African Queen* and *Tarzan the Ape Man*, respectively. Additionally, this research analyzes female roles of Diouana and Rama from the Francophone-African films *La Noire De…* and *Xala*, respectively. Despite the great racism and sexism that black women were subjected to in American films, their dignity and intelligence were recognized in African films.

MODERN & CLASSICAL LANGUAGES

The Role of the French Communist Party During World War II

Robert Lampen
Mentor: Dr. Brigitte Hamon-Porter
Department of Modern and Classical Languages

For many French citizens, the Resistance during World War II represents a proud symbol of the country's willingness to come together and fight for the greater good. During this time many groups fought against the Nazis: men and women, city and country folk, and even conservatives and communists. This research explores the presence and impact of the Communist Party during the Resistance. Before the war, the French Communist Party was actively protesting and fighting Fascist forces. In 1939, however, the Soviet Union signed the German-Soviet Nonaggression pact, and the Party became much more neutral. This research looks into the Party's use of propaganda, particularly newspaper articles by *L'Humanité*, and how they reflect the Party's views and actions during the first half of the war. This research attempts to distinguish the actions of the Communist Party and those of communist individuals during this portion of the war. The establishment and effectiveness of the *Maquis*, groups of rural fighters who fought against Axis powers, are also discussed.

Alexandra DeJongh, Modern and Classical Language, presenting at the Celebration, 2015.

Disguise, Kindness, and Musical Magic: The Triumph of Goodness in Rossini's La Cenerentola

Genevieve Janvrin
Mentor: Dr. Julia Randel
Department of Music

The familiar story of Cinderella has many variants, however Gioacchino Rossini's operatic version, *La Cenerentola, Ossia La Bontà in Trionfo* (1817), contributes unique character developments expressed through the music. This paper presents an analysis of the opera with specific references to the development of the heroine's character through the music. The focus is on the manifestation of "goodness triumphant" within Rossini's structured score; Cenerentola's simple generosity and kindness is conveyed through the use of ornamentation, dynamic level, and orchestral accompaniment. The composer suggests that Cenerentola's "true self" manifests around the quiet and melancholy D-minor folk song she sings in the beginning of the opera. This aria is contrasted with her stepsister's frantic and petty dialogue to showcase the heroine's simplicity and kindness. In the libretto, Cenerentola changes social classes by wearing a disguise; Rossini illuminates this change in the score. When she is in disguise at the ball, Cenerentola's vocal score is grander, with less orchestral accompaniment. However, the music reveals that the heroine's temporary change in social class due to her disguise is not the solution to her problems. Her extravagant vocal line foreshadows Cenerentola's forthcoming happiness as the future bride of Ramiro, but ultimately does not showcase her "true self" in life or in love. In addition, Rossini proves through the music that her qualities make her a worthy match for the love-struck and simplistic Don Ramiro. Cenerentola's folk song is used for comparison; the duet the two characters share begins with a similar melodic structure to the heroine's folk song. Placed in a major key instead of minor, this musical comparison suggests that Don Ramiro will play a part in reversing Cenerentola's current misfortunes. Although Rossini's *La Cenerentola* strongly rejects any components of supernatural forces, the opera retains many of the magical elements from Grimm's fairy tale within a musical analysis of the score.

Integrating Music through the Holland Community: A Community Music School at Hope College

Matthew Milliken
Mentor: Dr. Julia Randel
Department of Music

This project focused on introducing the potential of a community music school nonprofit for the greater Holland, MI area. Substantial evidence from literature was created for an argument for arts and culture, and music nonprofits were considered and advocated for. Various nonprofits such as CultureWorks, the Boys and Girls Club, and the Holland Arts Council were considered for a potential community music program; Hope College was chosen for the consideration of such a program. A case was made as to why Hope College would be a strategic and sustainable organization to establish a music program that offers classes, lessons, and workshops to individuals of all ages, races, and economic backgrounds. With the Jack H. Miller Center for Musical Arts nearing completion, the college is presented with a unique opportunity to assess the needs and involvement between the Holland community and Hope College community. The research conducted offers an introductory argument for the implementation of a community music school at Hope College.

Theatre and Psychology: Bringing Dissociative Identity Disorder to Life Onstage

Lindsay Hall
Mentor: Professor Richard Perez
Department of Theatre

Research can be used to inform art in unique ways. In *Incomplete,* an original play by Hope College senior, Austen Boer, the central character of Alice suffers from dissociative identity disorder (DID). To explore the best ways to bring DID to life onstage, I served as the dramaturg for this student-produced show. My work focused first on researching DID, and then on collaborating with the cast and crew to incorporate my findings into the production. My research gave me the knowledge I needed to assist the actress playing Alice, helping her understand what it means to live with DID. Together, we discovered ways to portray DID that were both realistic and recognizable to the audience. My research contributed to the playwright's creative process as well. As both the playwright and the director, Austen was able to make changes to the script based on my findings. The research also informed certain directorial choices that were made. Through our collaboration, he gained a deeper understanding of DID, which was beneficial for both the premiere of the play and the script's future development. By adding this research component to the play's production, the cast, crew, and audience all came away with an enriched understanding of DID, Alice, and the play as a whole.

Urinetown Prompt Book

Jacqueline Marschke
Mentor: Professor Michelle Bombe
Department of Theatre

The Hope College Theatre Department produces a musical every other year. Producing a musical is a considerable undertaking for directors, actors, musicians, designers, and technicians alike. As a collaborative art, musical theatre displays the creative knowledge and talents of multiple artists. The stage manager is responsible for recording the progress of the production from each of the departments (directors, cast, musicians, design teams, etc.). As the conduit of communication, the stage manager is tasked with keeping communication lines open between every member of the production team. This is accomplished via emails, production meetings, rehearsal and performance reports, technical plots, and other forms of documentation. The stage manager ensures that needs are being met for everyone involved throughout the process – from pre-production to the final performances. Clear, concise, and prompt recordkeeping ensure that every creative team member can work efficiently and effectively to realize the vision of the production. This project, "Urinetown Prompt Book," showcases the documentation work that stage manager, Jacqueline Marschke, for the theatre department's Fall 2014 production of *Urinetown,* a musical set in a futuristic dystopia where all the citizens are taxed to use public restrooms. This particular production included an off-site designer, so this project will reflect the use of Skype, Google Docs, and Dropbox as additional communication tools that a stage manager can utilize.

The Children's Hour Dramaturgical Research

Mollie Murk
Mentor: Dr. Daina Robins
Department of Theatre

This spring, the Theatre Department is producing *The Children's Hour* by American playwright, Lillian Hellman. She tells the story of two headmistresses of a private boarding school who are accused of a scandalous affair by one of their wealthy students. The rumor spreads rapidly, and the two women are forced to fight to keep their lives together amidst a flurry of accusations and interrogations. The play is based on an essay titled: "Closed Doors, or The Great Drumsheugh Case," which follows a real 1809 court case that took place in Scotland. When it was originally produced in 1934, the play was banned in Chicago, Boston, and London due to the allusions to homosexuality. Although

Hellman has endured further banning and censoring of the play, it is revered as a great American dramatic work. As the dramaturg for this production, I conduct research on the play's historical context in order to help the cast and creative team portray the complex relationships and situations presented in the play. I also compile materials to aid the audience's understanding of the play, such as the lobby display and program note. *The Children's Hour* addresses themes still present in our community today, and provides an opportunity to study the way those themes were punctuated and dealt with across the timeline of American theatre history.

Dramaturgy for *End Days*

Theodora Zucker
Mentor: Dr. Daina Robins
Department of Theatre

As the dramaturg for *End Days*, I researched aspects of the play in order to educate the cast and crew on the lesser known topics mentioned in the script. This large range of topics included Stephen Hawking and his book, *A Brief History of Time*, as well as information on 9/11, what Ground Zero looks like today, Elvis Presley, and various Doomsday prophecies. I compiled my findings into a binder that was available for the cast and crew to reference. I also spent the beginning of one rehearsal presenting my findings to the cast. In addition to this research, I attended production meetings for the play and wrote a dramaturgical program note sharing my experience. Finally, I wrote the text and found images for the informational lobby display posters that were available for theatregoers to look at before the performances.

Katelyn Kiner, Mellon Scholars, presenting at the Celebration, 2015.

Prayers, Tithes and Tweets: A Rhetorical Analysis of Joel Osteen's and Pope Francis's Discussion of Fruits of the Spirit on Twitter

Allison Barnes
Mentor: Dr. Robert Fortner
Andrew W. Mellon Scholars Program and Department of Communication

With many believers worldwide, the Christian Church is organized by countless individuals in leadership roles. Yet, despite many active members, Christians are led by influential leaders who attract millions of followers each, such as Joel Osteen and Pope Francis. Pope Francis and Joel Osteen shape masses through their messages and content, which are becoming increasing accessible through social media channels like micro-blog Twitter. Although theological differences occur, Catholics and Protestants agree on Christianity's major premises. Thus, Pope Francis and Joel Osteen's Twitter feeds should contain somewhat similar Christian content and instruction to their followers, such as encouraging the practice of the fruits of the Spirit. The current study asks, "How similar are Joel Osteen's and Pope Francis' Twitter feeds in teaching how to live a virtuous Christian life according to fruits of the Spirit?" Using cluster criticism, a critical approach to rhetoric, an analysis was performed on a sample of Joel Osteen and Pope Francis's tweets to compare content and understand if these Christian leaders shared similar rhetoric. Although Pope Francis and Joel Osteen had some similar tweeting habits, Pope Francis's tweets contained much more fruits of the Spirit content than Joel Osteen's. Additionally, Pope Francis's interpretations appear founded in Biblical scripture and traditional Catholic Church doctrine whereas Joel Osteen's tweets contained mostly Prosperity Gospel and positive self-help thinking. These two distinct messages involve very different rhetoric. These results help describe the complexity and division of the Christian church today and signify a deeper power struggle between shifting ideologies of the Christian church, specifically the evangelical American mega-church and the liturgical Catholic Church.

Holland's Centennial Park and the Greater Movement for Public Greenspaces

Joshua Briggs, Austin Garcia, Olivia Pilon, and Miriam Roth
Mentor: Professor Alex Galarza
Andrew W. Mellon Scholars Program

This project is based upon archival and database research and culminates in the construction of a short documentary on Holland's Centennial Park and its place in the wider urban greenspace movement. Centennial Park, founded in 1876 in celebration of the United States' centennial anniversary, formed during an era of urban planning and improvement across both the United States and Europe. During the nineteenth and twentieth centuries, a variety of purposes, including combating the debilitating effects of urbanization and creating an environment for sociopolitical conversation, motivated the development of urban greenspaces. It was in this context that the land in central Holland, originally set aside as a European-style marketplace, instead grew into a landscaped park. While Centennial Park held a place in the larger urban greenspace movement, Holland's status as a small but budding Dutch-American town also caused it to develop its own unique dynamic. Centennial Park engendered both civic and national pride in its use as a gathering place and a pocket of natural beauty, a treasured part of Holland's culture in the decades following its birth. By studying the historical role of Centennial Park in a broader context, this project contributes a deeper understanding of the park to those who visit it today.

A Church Divided: The RCA and CRC Schism

Jessica Cronau, Elizabeth Ensink, Matthew Meyerhuber, and Jonathan Tilden
Mentors: Dr. Courtney Werner and Professor Alex Galarza
Andrew W. Mellon Scholars Program and Department of English

The schism between two Dutch churches, the Christian Reformed Church (CRC) and the Reformed Church in America (RCA), shaped the demographic and cultural landscape of Holland, Michigan. While most research on the schism appears in books and articles, our project presents this history in a simple, accessible way using an interactive timeline on digitalholland.hope.edu. We draw on interviews, archival research, and existing literature on the topic to critically compare Dutch identity, liturgy, schooling, and worldview in these respective churches. The theological differences underlying the schism are clear, but we have investigated the demographic and cultural identity issues that may have had an even greater role in the schism. Many of the immigrants to America coming from the more theologically liberal state church in the Netherlands joined the CRC, which held significantly more purist views. One of the founding impetuses behind the CRC was the preservation of Dutch culture. The RCA was traditionally based in a worldview that embraced ecumenism and American culture whereas the CRC prioritized doctrinal purity. The CRC claimed separatism because they believed they were the one true church. Thus, we tentatively conclude that one of the main motives behind the founding of the CRC was their desire to preserve Dutch culture.

The Many Voices of Guenevere: Polyphony in "The Defence of Guenevere"

Dorothy Dickinson
Mentor: Dr. Curtis Gruenler
Andrew W. Mellon Scholars Program and Department of English

In his poem "The Defence of Guenevere," William Morris takes one of the most contentious characters in all Arthuriana and allows her to speak for herself. Guenevere, about to be burned at the stake for her adultery, argues her case before her accusers. The result is a layered, interesting monologue, in which Guenevere employs a range of different and disparate voices in order to confuse, accuse, and appeal to her listeners. Mikhail Bakhtin, in his work on literary theory, calls this ability to take on different voices "polyphony". In my project, therefore, I explore the connections between Guenevere's monologue and Bakhtin's idea of polyphony, as well as the connections between the personas Guenevere assumes (of storyteller, lady, and knight) and the theories of deconstruction, new historicism, and feminism. By examining these links, it becomes clear that the Guenevere in this piece has transcended the role expected of her. She acts through the non-action of speech. She is focalised by the narrator and yet subverts that focalisation for her own cause. She stands accused and yet accuses. By multiplying her one voice into many, Guenevere shows herself to be complex and therefore human.

Youth and Development: At-Risk Youth in the Holland Community

Jennifer Fuller, Robert Lampen, Hayley Schultz, and Anikka Van Eyl
Mentors: Professor Alex Galarza and Dr. Courtney Werner
Andrew W. Mellon Scholars

Childhood and adolescence stand out as the most pivotal times of development and growth. During these years, we begin to develop as individuals and our beliefs begin to take shape. For many children, these years are racked with suffering and turmoil and unfortunately many children end up walking down paths that lead to life-altering consequences. This research project addresses at-risk youth in the greater Holland area and the various services such as housing, reintegration, and mentoring that are provided by local organizations. Looking at six major categories that are often associated with at-risk youth—abuse and neglect, delinquency, homelessness, substance and alcohol abuse, teen pregnancy, and truancy—we researched the organizations, via individual interviews with organization leaders, associated with each category and then matched a specific organization to each of these. We examined the reasons that the founders created these organizations and why they chose to focus on a

Program and Department of English

particular problem in the community. We aimed to find out whether these organizations adequately served the issues facing at-risk youth, and if not, find where these gaps exist. This project culminates in a digital collection of narratives from the people involved in each organization. The narratives displayed on this website present our research in a readily available format for community members to access. This project serves as a base platform for further research concerning the state of at-risk youth in Holland.

From Satire to Struggle: An Analysis of Changing American Identity Using *Our Show; a Humorous Account of the International Exposition*

Hope Hancock
Mentor: Dr. Jeanne Petit
Andrew W. Mellon Scholars Program and Department of History

In 1876, Philadelphia hosted the Centennial Exhibition to commemorate the 100th anniversary of the signing of the Declaration of Independence. The Exhibition operated as a platform for the United States to showcase all of its innovations and demonstrate how far the young nation had come in 100 years. The Exhibition quickly gained international popularity and attracted 10 million visitors over the span of the six months it was open. However, not all Americans took the Exhibition so seriously. *Our Show; a Humorous Account of the International Exposition*, co-written by Philadelphians David Solis Cohen and Harry B. Sommer, is a satirical book that was published in 1875, prior to the opening of the Exhibition. In *Our Show*, Cohen and Sommer poked fun at everything from the building materials used to the members to the Centennial Board. The authors used *Our Show* to provide a platform for Americans to grapple with the fluctuating identity of the United States. Relying on ambiguity and wit, Cohen and Sommer discuss ways that United States' society was changing in terms of women's roles in society, the rise of industrialization, and the growth of an excessive culture. This project explores how historians can use humorous and satirical publications to understand the impact of social change in American society.

Digital Holland, Michigan

Hope Hancock, Allyson Hoffman, and Madalyn Northuis
Mentors: Professor Alex Galarza and Dr. William Pannapacker
Andrew W. Mellon Scholars Program and Department of English

This project was supported by The Andrew W. Mellon Foundation Scholars Program in the Arts and Humanities at Hope College.

Inspired by the American Guide Series of the Federal Writers Project, Digital Holland, Michigan, is a publicly accessible website that hosts research about the communities that include and surround Hope College. The website, digitalholland.hope.edu, was developed by students in the college's Mellon Scholars Program. After the first two months of research and development, the website has an interactive map, galleries, and more than 160 pages on topics such as people, places, and events, highlighting the diversity and historical importance of the communities. The site also hosts relevant artifacts including images, audio, and video files shared with permission by the Joint Archives of Holland and the Holland Museum. For example, the page "Tulip Time" includes footage from the Tulip Time festival, audio from the original Tulip Time song, interviews with participants, and concise descriptions of the event and links to related events. Additionally, the project engages with and serves the surrounding communities. With the support of faculty and staff mentors, the student developers made connections on campus and in the community with the goal of augmenting and developing the site through crowdsourcing. Through a partnership with the Great Lakes Colleges Association's "Expanding Collaboration" initiative, Digital Holland, Michigan is expected to become a pilot for a constellation of projects across 13 institutions—Digital Great Lakes—that will explore local culture, support collaborative research, and engage the communities of the region. The project necessitates interdisciplinary collaborative research and represents an approach to undergraduate education

that emphasizes high-impact learning practices. Community engagement is another important element of the project; both suggestions and contributions are welcomed from community members. Through this project students have made a case for the value of the humanities in everyday life.

"That God May be All in All": Deification, Nothingness, and Creaturehood

Andrew Peecher
Mentor: Dr. Jared Ortiz
Andrew W. Mellon Scholars Program and Department of Religion

This research was supported by the Jacob E. Nyenhuis Student/Faculty Collaborative Research Grant.

At the close of the 19th century, Adolf Von Harnack sparked an unintentional return to interest in the doctrine of deification. In his *History of Dogma*, he accused the doctrine of being little more than Greek philosophy in Christian dress. In turn, a number of scholars came to the defense of deification in the early-to-mid 20th century, and currently a growing pool of scholars is taking especial interest in the doctrine. Amongst these, John Zizioulas has recently given an account of deification in his works *Being in Communion* and *Communion and Otherness*. Therein, Zizioulas argues for a doctrine of deification that creates an ontological bond between God and the world at the level of God's *hypostasis* or personhood while allowing distinctiveness to remain between God and the world on the level of being. But can Christians articulate deification in this way? To what degree ought Christians to think of God's relationship with creation as an ontological one? In my paper, I will outline Zizioulas' account of deification before providing an analysis. For the analysis, I introduce voices from the Christian tradition and recent philosophy concerned with ontotheology. These help to show that, while Zizioulas aims to uphold an appropriate ontological difference between Creator and creation, he ultimately collapses the two in a manner inconsistent with Christian affirmations of divine transcendence. Finally, I give a positive account of deification based on the works of Maximus the Confessor and Søren Kierkegaard. These show that a Christian doctrine of deification neither should nor does it have to encroach upon divine transcendence. Ultimately, this study aims to provide the Church with an understanding of how its work partners with God's in the world.

Impact of On-Campus LGBT Resources and Campus Climate on College Students: A Two Campus Comparison

Charlyn Pelter
Mentor: Dr. Debra Swanson
Andrew W. Mellon Scholars Program and Department of Sociology and Social Work

Campus climate regarding lesbian, gay, bisexual, and transgender (LGBT) individuals can have a profound effect on the academic success and social wellbeing of these students, staff, and faculty. This study was a qualitative, mixed methods design comparing a large public university and a small liberal arts college. It examined the connection between the presence of LGBT resources and the campus climate toward LGBT persons. I predict a campus with an open, accepting policy and available resources for LGBT students, such as those at the larger university, will have a climate that makes students feel safe, protected, and open. This study found policy does have an effect on the climate. Additionally, faculty may be more aware than students of policy issues and the effects they have on the campus environment. Regardless of policy and resources, members of both campuses hope the campus climate continues to improve for all students.

Charlyn Pelter analyzing interview data for her research.

Operation Swing Phase 2: Music Personalities in World War II

Colin Rensch
Mentors: Dr. Marc Baer and Dr. Brian Coyle
Departments of History and Music and the Andrew W. Mellon Scholars Program

Besides the musical contributions of popular bandleaders and their famous jazz bands, bands of regular soldiers entertained their regiments while off duty during World War II. This past summer I researched the stories of such World War II veterans through the digital collections of the Library of Congress Veterans History Project, Grand Valley State University, and the National World War II Museum. The work I conducted was a further step in my research on the role of jazz music in World War II and was sponsored by the summer fellowship program of the Mellon Scholars Program. The central argument of my Mellon project is that jazz music contributed to the success of the Allied war effort by helping to sustain the morale of soldiers and citizens who listened to jazz on a regular basis, by contributing financially to the effort through its performance at war bond fundraising concerts, and by personifying the American spirit of freedom. This past summer I listened to the stories of veterans to find out just how important the music was to them and if they were involved in service bands during their tours of duty. As part of the digital component of my project, I created a website to showcase this research and named the site after the name of my project: operationswing.com. Currently, the site contains the stories of four veterans who were particularly involved in jazz bands or affected by the performance of jazz during the war: Raymond Gill, Harold Fritzsche, Carl Henn, Jr. and Harry Connick, Sr. I will be continuing to add to the website, so stay tuned for more about the greatest generation and the greatest music of their time.

Love Is an Orientation: Dialogue about Christianity and Sexuality

Katherine Sauer
Mentor: Dr. Julie Kipp
Andrew W. Mellon Scholars Program and Women's and Gender Studies Program

When it comes to culture war issues, everyone has an opinion. Groups or institutions whose constituents are of mixed opinions find themselves in the middle and struggle with the tension created by these divisive issues. Hope College is not immune from the struggle, particularly regarding sexuality. This project serves as an experimental attempt to address the need for bridge building and conversation about sexuality as it relates to Christianity. The *Love Is an Orientation* DVD curriculum produced by the Marin Foundation was used as the instructional foundation of a series of workshops for students, with the purpose of addressing issues of sexuality in a safe, structured way. The workshops emphasized dialogue as an effective format of communication because its purpose is to allow people of diverse views to achieve understanding through a process of listening, reflecting, and sharing. Through these dialogue-driven workshops, students can engage people from a variety of backgrounds in conversation in order to better understand the way that sexuality and Christianity come together.

Ethnic Studies in Holland, Michigan: Examining the Impact and Implications of Holland's Hispanic Population

Cullen Smith, Taylor Mills, William Harrison, Alexander Markos, and Katelyn Kiner

Holland has transformed from a small, historically Dutch community to one containing many different ethnicities. One such transformation occurred in the early-twentieth century with the arrival of migrant Hispanic workers from Latin America. As the community grew, so did its presence through festivals such as Tulipanes and bilingual masses like those at St. Francis De Sales Catholic Church. As a whole, the the cultural history of the Hispanic community continually manifests itself in Holland's industry, education, community, and religion. Research projects such as Greg Oltmann's "The Hispanics of Holland: An Examination of the Origins and Development of the Hispanic Community in Holland, Michigan" provides a small insight to the history and current impact this community is having in Holland. By exploring and analyzing the rich history

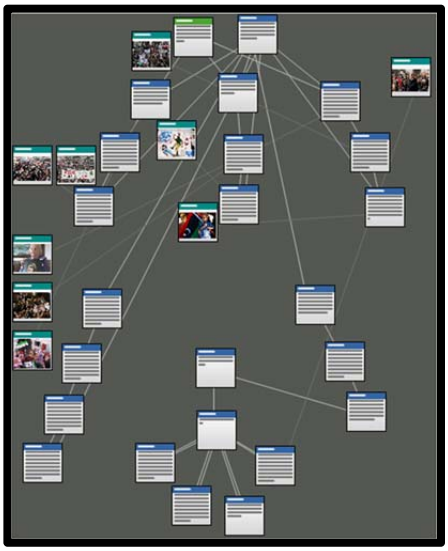
Mentor: Professor Alex Galarza
Andrew W. Mellon Scholars Program

of the Hispanic community in Holland, we hope to come to a better understanding of the impact of Hispanic culture on Holland and share this impact with the community itself. Our research will showcase the significant impact that the Hispanic community has had on Holland's education systems, industry, and culture through a documentary. We are compiling our research and interviews into a documentary that will be available on the Digital Holland website to act as a "looking glass" into the perspectives of Holland's Hispanic community. Through interviews with members of the Holland Hispanic community, this project explores the facets of a community that has been largely underrepresented on the Digital Holland website thus far. Finally, the project allows us to continue a local dialogue about Holland's established Hispanic community on Hope College's campus.

Much Love, BJP: Examining Gender and War through Interactive Fiction

Megan Stevens
Mentor: Professor Priscilla Atkins
Andrew W. Mellon Scholars Program and Women's and Gender Studies

The intersection of gender and war is often examined under two different banners, that of the victim of war and that of the soldier. This project looks at an underrepresented third party: the war correspondent. Inspired by the life of Marie Colvin, an award-winning war correspondent killed in the siege of Homs, Syria in 2012, "Much Love" is an interactive story relating the life of fictional war correspondent Bany Polzin. Among the themes examined are motherhood, friendship, and rape as a war crime.



Screenshot showing the progression of story in the game Much Love.

Conqueror of Death: A Study of Bacchic Imagery on Roman Sarcophagi

Claire Trivax
Mentor: Dr. Stephen Maiullo
Andrew W. Mellon Scholars Program and Department of Modern and Classical Languages

This project was supported by The Andrew W. Mellon Foundation Scholars Program in the Arts and Humanities at Hope College.

The Roman counterpart to the Greek god Dionysus, *Liber Pater,* invited his worshippers to free themselves from their inhibitions and social conventions. In festivals such as *Liberalia,* boys donned their adult togas for the first time, actors danced across the stage in celebration, and phalluses were revered and worshiped by all. And yet, even as this vibrant form of worship fell out of style after the second century BCE, there seemed to be a resurgence of this Roman Bacchic tradition carved all over sarcophagi from the mid-first century to the late third century CE, across the Roman empire. So why would a god who was so closely associated with life, fertility, and coming of age and whose popularity had dwindled during the Roman republic come to be depicted on sarcophagi centuries later in the Roman empire? In this project, I will examine depictions of the Ariadne myth on sarcophagi in particular which, as I will argue, reorient Liber worship toward Greek identifications of Bacchus as a figure who can conquer the finality of death. Ariadne is an ideal figure for such an occasion because, according to the tradition surrounding her, she was saved from death twice: first when Dionysus carried her off from Naxos then again at her apotheosis after her death. Although many versions focus on Bacchus' marriage, in *Fasti* 495-520, Ovid imagines Ariadne wishing she were dead after Liber brings home a new wife and that her unfaithful husband had never saved her from that

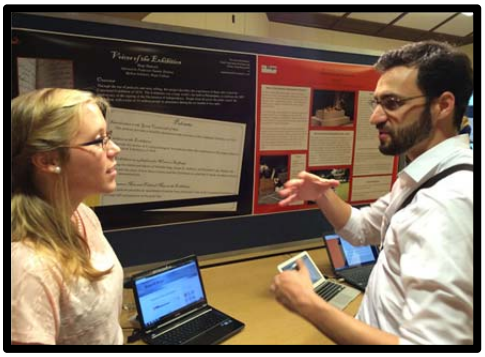
fate Theseus left her to. Despite this, Ovid tells us, Ariadne would be renamed Libera and take her place as an immortal among the stars. Stemming from the Ariadne-Bacchus marriage myth all other depictions of Bacchus on sarcophagi start to represent the want for the deceased to live on, immortalized in stone. Through his depiction on sarcophagi, *Liber* is transformed into the best representation of what we want our loved ones to have: eternal life, happiness, and freedom.

From Canvas to Stage: Matisse and Picasso as Costume Designers for the Ballet Russes

Mary Elizabeth Winther
Mentor: Professor Michelle Bombe
Andrew W. Mellon Scholars Program and Department of Theatre

In 1909, Sergei Diaghilev arrived in Paris with a troupe of dancers that would soon take the city by storm. This company, The Ballet Russes, would later revolutionize the world of dance, music, and art. Between 1909 and 1929 the company would dance in Paris, as well as across Europe in countries such as Spain, and in both North and South America. Diaghilev employed only the finest dancers, choreographers, and designers, including, between the years 1917 and 1920, the celebrated painters Pablo Picasso and Henri Matisse. Picasso and Matisse have long been considered pioneers in the art world and the fathers of distinct movements in painting, namely Cubism and Fauvism. Although the lives and works of Picasso and Matisse have both been the subjects of extensive research, little scholarship has been dedicated to analyzing the relationship between their paintings and their work in the performing arts. Through my research I hope to not only construct a scholarly and artistic analysis of their costume designs, but also begin to bridge the gap in understanding how their work for a ballet company fit into the longer story of their ever evolving painting styles. With the resources I have accumulated, in particular the photographic and textual sources that I was able to study in the research library housed in the Paris Opera House (a branch of the National French Library), I have begun to articulate an analysis of how the two-dimensional painting styles of Picasso and Matisse translated into three dimensional costumes.

Allyson Hoffman and Erika Schlenker, winners of the top prize for undergraduate project building at the September, 2014 Network Detroit conference for their work on "Digital Holland, Michigan."



Hope Hancock at the Summer Research Showcase presenting her work on diversity at the 1876 Centennial Exposition with Alex Galarza, the Digital Liberal Arts Fellow for the Mellon Scholars Program from Michigan State University.

GMOs: Salvation for Impoverished Farmers? What Economic Effect can GMOs have on the Farmers of African Countries and India?

Fernando Bahena, Sieun Lee, and Astrid Mendez
Mentor: Professor Yolanda Vega
Phelps Scholars Program

Genetically Modified Organisms (GMOs) are organisms whose genetic material has been modified to alter their functions, typically to increase crop yields. GMOs have been blindly blamed for the distress that farmers in developing countries face and viewed as detrimental to the society due to their environmental hazards and potential human health risks. This research aims to debunk myths concerning the GMOs and highlight the advantages to growing GMOs for farmers in the world fighting against poverty and starvation. GMOs have been highly successful in countries that implement genetically modified soybeans and Bt cotton. Although many African countries are against GMOs, Burkina Faso and South Africa, two of very few that have planted GM crops have witnessed a tremendous economic growth and have proved the potential of GMOs in saving people of hunger and poverty. India, a main Bt cotton grower, has also seen a dramatic increase in cotton yield. GM crops have shown to create a future for the farmers rather than destroy them, but the actual problem behind GMOs is the monopoly of multinational agribusiness corporations, full of gluttony. International acceptance of GM crops and support from global public sectors are needed to battle these companies and to further assist farmers who comprise the majority of the impoverished in the world.

Sweatshops: How Can We Change An Industry That is So Inherently Intertwined With Today's Culture?

Victoria Chavarria, Rebekah Loker and Brenda Torres
Mentors: Professors Amy Otis-De Grau and Yolanda Vega
Phelps Scholars Program

Many people around the world work eighteen hours a day with no air conditioning and no bathroom breaks only to receive less than minimum wage. According to the U.S. Department of Labor, this would be defined as a sweatshop because it violates two or more labor laws. Due to the fact that sweatshops pay more than other businesses in the community, it is unrealistic to request the eradication of these sweatshops however a transformation is necessary. One of the major reasons that sweatshops still exist today is that our society places such a high value on consumerism. Since it appears that most individuals are unwilling to stop buying their favorite brands, we decided to survey Hope College students for their thoughts. Would they be willing to pay extra for products from their favorite brands if that ensured workers would receive wages on which they could survive? The overall response was yes; 80% said that they would be willing. Therefore, the ideal way to confront this problem would be to simply remove the "sweat" from the sweatshops by spreading awareness about the sweat and tears behind our favorite brands and striving to place a higher value on human lives than on consumerism.

What the World Sees, But What's Really Inside

Kiveran Davidson, Jessica Moore, and Curissa Sutherland-Smith
Mentor: Professor Yolanda Vega
Phelps Scholars Program

The cultural identity of an individual is one that takes time to develop, no matter a person's ethnicity or race. The question many individuals ask themselves is "Where do I fit in this world?" This question arises especially in those who are adopted. Individuals adopted from different cultures have a unique experience with identity development because they may be isolated in terms of cultural representation in his or her adopted community. Through research we sought to find how adopted individuals form their distinct cultural identity in this context, and what hindered or helped the process of identity development

The Importance of Education on Free and Fair Voting in Sub-Saharan Africa

Kyle Funk, Matiana Medrano, and Kristen Szalontai
Mentors: Dr. John Yelding and Professor Yolanda Vega
Phelps Scholars Program

According to the international charity organization Free the Children, 58 million primary school-aged children in the world are not in school. In sub-Saharan Africa, more than 21 million adolescents were not in school in 2007, equivalent to 38% of the lower secondary school age group. Of the 925 million people in Sub-Saharan Africa, only 12% are free. These statistics persuaded us to study just how strong of an impact education has on democracy, freedom, and political participation in Angola, Kenya, and South Africa. We studied the primary school education rates, examined political participation rates, and performed interviews to further our understanding. We found that education is critically important for maintaining freedom and democracy, and it is extremely important to support education in these countries.

Evolution of Today's Crisis in Iraq and the Levant: What are the Underlying Historical and Cultural Factors for the Rise of the Islamic State?

David Kallgren and Kevin Rukundo
Mentors: Professor Yolanda Vega and Dr. John Yelding
Phelps Scholars Program

This research aims to describe the rapid growth of the Islamic State (IS), also known as ISIS or ISIL. Drawing facts from news articles, scholarly publications, and recent investigations conducted over the group, we have sought to illuminate the core ambitions and principles that created IS and to discuss the short- and long-term implications for the region.

Transracial Adoption: Faith, Race, and Home in Multiethnic Countries

Joshua Chun Wah Kam, Noah Groth, and Kimberly Lopez
Mentor: Dr. Kristen Gray
Phelps Scholars Program

More than ever before, the question, "Where am I from?" becomes harder and harder to answer. Globalization has deeply affected the field of transracial adoption (or TRA), in which a child of one culture is adopted by parents of another. Transracially-adopting families worldwide are raising important, very human questions in their communities: Where's home? Can I call two homes home? Are we perpetuating or challenging racism? What can we learn from history? We would like to invite our community to listen, learn, and even challenge its assumptions of what home, adoption, and community really mean in an ever-diversifying world. Ultimately, communities need to realize that race and ethnicity are very different constructs, and that transracial navigation— negotiating the often bewildering boundaries of human diversity— is vital to truly understanding the complexities of TRA youth and their families.

PHELPS SCHOLARS

Sex Tourism: The Industry of Buying Souls

Gianna Ramirez and Leigh Wynveen
Mentors: Dr. Charles Green and Professor Yolanda Vega
Phelps Scholars Program

Sex Tourism, the act of traveling from one's nation of origin to another nation with the primary motivation of having commercial sexual relations, is a global issue. The sex tourism industry affects wealthy and poor nations. Sex tourism has a negative effect on sex workers, the societies of the home nations of tourists, and the destinations. The international response to sex tourism furthers the industry and rarely seeks justice for the victims. In some cases, international involvement only enhances the stigma against sex workers. Thailand and the Netherlands serve as two vastly different case studies to determine government intervention and the brothel's power in the international business world. The findings showed that the emotional and physical abuse sex workers face at the hands of tourists are often ignored due to bribes, power positions, and laws that turn a blind eye away from foreigners.

Tobacco Production and Undernourishment in Zambia

Brandon Wolliston and Clarisa Chavez
Mentors: Dr. John Yelding and Professor Yolanda Vega
Phelps Scholars Program

This research explores the correlation between the production of tobacco and undernourishment in developing countries. Zambia was used as an example because of its high rates of undernourishment and tobacco production. We researched the positive and negative effects of tobacco growth in this country, as well as its agricultural potential. We concluded that most of the farmers grow tobacco to trade it, instead of using the agricultural potential in this country to grow food and therefore reduce undernourishment rates and food insecurity.

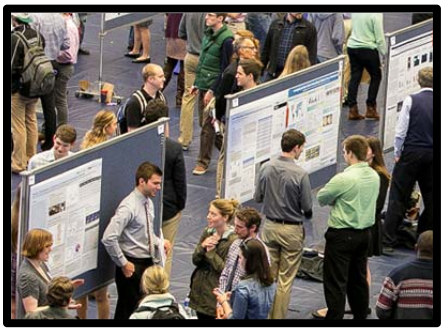
Curissa Sutherland-Smith, Joshua Chun Wah Kam and Noah Groth, Phelps Scholars, presenting at the Celebration, 2015.

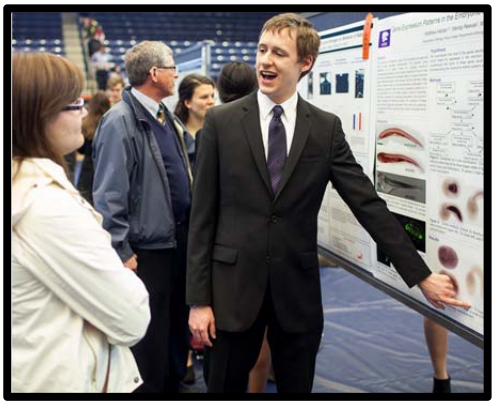
Microbial Tracking to Identify Fecal Contaminants in Recreational Surface Waters

Brandy Mullen, Roudeland Metellus, Megan Munger, and Luke Ragon
Mentors: Dr. Michael Pikaart and Dr. Graham Peaslee
Departments of Biology and Chemistry

Over the past 2 years, the Pikaart research group has been working in parallel with the Outdoor Discovery Center to help remediate the Lake Macatawa Watershed. Project Clarity, is a $12M plan set forth by the Outdoor Discovery Center/Macatawa Greenway and other organizations to restore the watershed to its former glory. Project Clarity's goals are to improve the water quality by reducing the amount of sediment, nutrients, and bacterial pollution. With a multi-faceted approach to long-term sustainability, best management practices, land restoration, and community education, the watershed can be restored in time. To further investigate the cleanliness of the water, the Pikaart group has been working to identify the fecal contaminants in the Lake Macatawa watershed. This is done by tracking the source of the contaminants using qPCR. With qPCR, the microbiological 16s RNA gene sequence is amplified based on primer sets to track the potential sources of the microorganisms. The findings from various sample locations will be discussed along with plans for the future.

Research funded by Outdoor Discovery Center/Macatawa Greenway and the National Science Foundation.





From left to right: group of Biology projects, Kyle Cushman, Biology, explaining a phage project, and Matthew Harder, Biology, presenting at the Celebration, 2015.

BIOLOGY

The Influence of Building Size and Window Characteristics on the Frequency of Bird Fatalities at Hope College

Michael Barrows, Nicholas Gibson, Emily Kindervater, Courtney Lohman, and Alex Vandervest
Mentor: Dr. Kathy Winnett-Murray
Department of Biology

Urban landscapes have drastically altered natural environments. One consequence of these changes is the increase in avian mortality due to collision with human structures such as wind turbines and skyscrapers. Bird-building collisions may be responsible for up to one billion avian deaths per year in the United States. As a part of the Ecological Research as Education Network (EREN) Bird-Window Collision project, we investigated the effect of building size, window area, and the orientation of a building on the frequency of bird window collisions (BWCs). Bird carcasses were collected from six buildings on the Hope College campus in Holland, Michigan over 21 consecutive days during the fall migration in 2014. More collisions occurred at campus buildings with greater total floor space and at those with greater window area. The date, building side orientation (N, S, E, W), and bird species all had insignificant effects on the number of bird window collisions. However, half of the carcasses collected were found under north facing windows, suggesting a larger sample size might allow demonstration of a significant effect of the building side orientation. We also noticed a high frequency of Ruby-Throated Hummingbird (*Archilochus colubris*) fatalities which might indicate a greater susceptibility of this species to window collisions. It is our hope that this study will supplement current bird window collision research as well as inform policy makers of the impact of bird window collisions, and how those impacts may be reduced.

This research was supported by the Biology Department, Hope College and by the Ecological Research as Education Network (EREN), a Research Coordination Networks program funded by the National Science Foundation.

Isolation of 35 Mycobacteriophages and Genomic Analysis of the Novel Mycobacteriophage, Bella96

Keagan Belyk, Jacob Conroy, Kyle Cushman, Monica Elliott, Joseph Fifer, Sean Gitter, Austin Gutting, Emily Kain, Danny Kosiba, Sieun Lee, Kim Nguyen, Nicholas Parliament, Hayley Reitsma, Maxwell Sievers, Stephen Talaga, Philip Versluis, Yong Chul Yoon, Robert Zick, and Molly Bogolin
Mentors: Dr. Aaron Best and Dr. Joseph Stukey
Department of Biology

Thirty-five new mycobacteriophages were isolated from soil samples collected on or nearby Hope College in Holland, Michigan. All were capable of infecting *Mycobacterium smegmatis* and produced a variety of plaque morphologies based on size, shape, and clarity, consistent with the isolation of an assortment of different phages. Both lytic and temperate phages appear represented in this collection. Purified phage stocks were used to prepare genomic DNA samples for restriction digest analysis. A comparison of those 35 digest results revealed few similarities among the group, further supporting our interpretation that most of the new phage isolates were distinct. One mycobacteriophage, Bella96, was chosen for complete genome sequencing using the Illumina MiSeq platform and comparative genomic analysis. The predominant plaque produced by Bella96 at 32^0C was turbid and 3 mm in diameter. No plaques grew at 42^0C. Genome sequence data for Bella96 revealed a relationship to a group of 23 mycobacteriophages in Cluster K1. The genome of Bella96 is 60.7 Kb, 66.1% GC, and contains 97 genes in agreement with the genome characteristics of closely related phage. A detailed analysis of the complete genome sequence and comparison with sequenced members of this small and unique group of mycobacteriophages is the subject of the second semester of this yearlong course and is presented.

This research is supported by the Howard Hughes Medical Institute SEA-PHAGES program.

Isolation of 35 Mycobacteriophages and Genomic Analysis of the Novel Mycobacteriophage, Glass

Morgan Dalman, Haley Fischman, Ester Fletcher, Kevin Franz, Jessica Guillaume, Emma Hardy, Abagail Jeavons, Clara Jurik, Adam Krahn, Alyssa Machay, Emily Mejicano-Gormely, Matthew Petrovich, Chase Platte, Alison Rich, Jada Royer, Mary Clare Theis, Natalie Vela, and Carl Deeg
Mentors: Dr. Aaron Best and Dr. Joseph Stukey
Department of Biology

Thirty-five new mycobacteriophages were isolated from soil samples collected on or nearby Hope College in Holland, Michigan. All were capable of infecting *Mycobacterium smegmatis* and produced a variety of plaque morphologies based on size, shape, and clarity, consistent with the isolation of an assortment of different phages. Both lytic and temperate phages appear represented in this collection. Purified phage stocks were used to prepare genomic DNA samples for restriction digest analysis. A comparison of those 35 digest results revealed few similarities among the group, further supporting our interpretation that most of the new phage isolates were distinct. One mycobacteriophage, Glass, was chosen for complete genome sequencing using the Illumina MiSeq platform and comparative genomic analysis. The predominant plaque produced by Glass at 32°C was turbid and 0.5-1.0mm in diameter, while plaque produced at 42°C was clear and 1.0-1.5mm in diameter. Genome sequence data for Glass revealed a relationship to a group of 12 mycobacteriophages in Cluster B2. The genome of Glass is 67.5 Kb, 69.0% GC, and contains 91 genes in agreement with the genome characteristics of closely related phage. A detailed analysis of the complete genome sequence and comparison with sequenced members of this small and unique group of mycobacteriophages is the subject of the second semester of this yearlong course and is presented.

This research is supported by the Howard Hughes Medical Institute SEA-PHAGES program.

Long Term Trends in Size Distribution of Eastern Hemlocks in West Michigan Dune Forests

Andrew Gomez-Seoane and Eric Hederstedt
Mentor: Dr. K. Greg Murray
Department of Biology

Size distributions of trees often yield valuable clues about changing environmental conditions and the responses of populations to them. In a recent study, the size distribution of Eastern Hemlocks was measured in several forests near Lake Michigan to determine whether active recruitment into the population was taking place at a similar rate as in the past. The diameter at breast height as well as cores samples were taken for all hemlocks present in selected stands. Analysis found that the size distribution was strongly skewed toward the intermediate and larger tree size classes suggesting a failure of recent recruitment relative to that in the past. Experimental transplantation of hemlock saplings in select stands has yielded a possible link with herbivory due to the gradual increase of white tail deer populations as the primary cause of decline among hemlocks. Other studies in the Lake Michigan region, both inland and coastal, have documented a perceived decline in hemlock populations based on sample data and paleoecological trends. If the observed trend continues into the future, Eastern Hemlock will most likely continue to decline in density in these forests over the long term.

Gene Expression Patterns in the Notochord of *Ciona intestinalis*

Matthew Harder
Mentor: Dr. Michael Veeman
Division of Biology, Kansas

The notochord is a hallmark organ of all chordates and plays key roles in early chordate development. The ascidian *Ciona intestinalis* is a useful model for studying notochord morphogenesis because it has a simple notochord of only 40 cells that can be visualized with subcellular detail in a single microscope image. RNA-seq studies in the Veeman lab have identified a large number of genes likely to be transcriptionally upregulated in the developing notochord. Here we report expression patterns by *in situ* hybridization for 20 of these putative notochord transcripts. 12/20 were confirmed to be strongly upregulated in the notochord, broadly validating the RNA-seq results. We identified 4 of these

State University
Collaborator: Dr. Wendy Reeves, Kansas State University

genes as being regionally expressed in the notochord, supporting our hypothesis that the notochord may contain functionally distinct cell identities.

This material is based upon work supported by the NSF under grant No. 1156571.

Mission Monteverde: Mathematical Rainforest Modeling

Benjamin Johnson and Grace Wiesner
Mentors: Dr. K. Greg Murray and Dr. Brian Yurk
Departments of Biology and Mathematics

The tropical rainforest is one of earth's most diverse and dynamic ecosystems. Tree- or branch-falls in the forest can open gaps in the canopy, allowing light to reach the forest floor. Pioneer plants are adapted to take advantage of these conditions, sometimes emerging many years after being deposited as seeds. Light conditions change as the gap closes, impacting rates of growth and reproduction. For the past 30 years, sizes and reproductive outputs of individuals of six pioneer plant species have been measured along five transects in the Monteverde Cloud Forest Preserve at Monteverde, Costa Rica. Each 500-meter transect was chosen to be representative of different conditions in some part of the cloud forest. To model the pioneer plant demographics, we classified canopy gaps by age and size and developed a matrix population model that accounts for the differing gap environments. We also created a stochastic matrix model of gap formation and regeneration to simulate the dynamics of rainforest canopy gaps. Combined, these models will allow us to simulate pioneer plant population dynamics in the changing forest environment, and to explore how reproduction and growth rate parameters, such as seed predation rates, impact pioneer population dynamics.

This research was supported in part by a grant to Hope College from the Howard Hughes Medical Institute through the Undergraduate Science Education Program, Jacob E. Nyenhuis Student/Faculty Collaborative Summer Research Grant and the Hope College Biology and Mathematics Departments.

Influence of *Buchnera* on the Detoxification of Fungal-Toxins in *Rhopalosiphum Padi*

Brittany Leonard
Mentor: Dr. Thomas Bultman
Department of Biology

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

The bacteria symbiont of many aphids, *Buchnera aphidicola,* is instrumentally important in the survival of aphids. The bacteria supply essential amino acids, which aphids do not acquire from their diet of phloem sap. However, there is little knowledge of the symbiotic relationship beyond this and it is possible the bacteria are involved in detoxification of toxins. Aposymbiotic (without bacteria) aphids were obtained by feeding them antibiotics via barley. Disruption of bacteria was assessed with PCR and light microscopy. These aphids and symbiotic aphids (*Rhopalosiphum padi*) were placed on both infected (containing the endophyte, *Neotyphodium coenophialum*) and uninfected tall fescue (*Schedonorus arundinaceus*) for a week. The number of live aphids was recorded and analyzed. Two experiments were performed and the results of the two experiments were contrary to what was expected. The aposymbiotic aphids survived significantly better than symbiotic aphids in the first experiment and both aposymbiotic and symbiotic aphids survived equally well in the second experiment. Further tests will need to be performed to confirm the disruption in the aposymbiotic aphids.

A Potential Interaction Between Homocysteic Acid and Estrogen on Behavior in Rats

Lize Loubser and Shirly Samuel
Mentor: Dr. Christopher Barney
Department of Biology

This research was supported by the Walker-Barr Science Summer Research Fund.

Homocysteic acid (HCA) is a neurotoxin that can over stimulate NMDA receptors, leading to neuronal cell death. In humans, hyperhomocystemia, which can lead to elevated HCA levels, has been associated with a host of mental disorders, including schizophrenia, Alzheimer's disease, Parkinson disease, and potentially Major Depressive Disorder. The purpose of the current study was to determine if estrogen altered the behavioral response to HCA or has behavioral effects on its own. Rats were treated with HCA for 2 weeks starting on day two after birth and then ovariectomized at 6.5 weeks of age. Half of the HCA treated and half of the control rats were given estrogen implants. Behavioral testing began three weeks later. There was a significant effect of estrogen in the Open Field Test, Elevated Plus Maze, Tail Flick Test, Rotarod Test, Sucrose Preference Test, Force Swim Test, and Wheel Running Test. There were significant effects of HCA in the Elevated Plus Maze and Open Field Test, Rotarod Test, and Morris Water Maze, and there were significant interactions between HCA and Estrogen in the Open Field Test. This experiment demonstrated that numerous behaviors in rats are estrogen dependent but behavioral responses to HCA are not very estrogen dependent.

Investigating Phage-Host Protein Interactions

Andrew Neevel and Morgan Cinader
Mentors: Dr. Virginia McDonough and Dr. Joseph Stukey
Department of Biology

Mycobacteriophages are viruses that infect bacteria in the genus *Mycobacterium*. The *Mycobacterium* genus is home to more than 100 identified species including the human pathogens that cause tuberculosis and leprosy. There is evidence that when mycobacteriophages initiate lytic growth – the phage development pathway that results in the immediate production and release of new phage particles concomitant with host cell death – key metabolic machinery of the host cell is strategically seized and redirected for phage replication. Further, the extreme genetic diversity evident in mycobacteriophage genomes suggests this class of viruses use multiple means to carry out this act of cellular piracy. However, the process by which even a single mycobacteriophage hijacks a host cell is unknown. In an effort to understand this process, we have identified multiple mycobacteriophage genes that are cytotoxic when expressed individually in the host *M. smegmatis*. We hypothesized that at least some of these cytotoxic effects are due to specific phage-host protein-protein interactions. The focus of this work is the cytotoxic VIX80 gene product from mycobacteriophage Vix. Vix gp80 was analyzed using biochemical techniques to find interacting host cell proteins. Vix gp80 was expressed in *E. coli* and used in a magnetic bead pull-down assay to isolate *M. smegmatis* proteins that bound to the phage gene product. *M. smegmatis* Elongation Factor-Tu was isolated using this technique and identified following protein analysis. The interaction of Vix gp80 and EF-Tu will be verified using additional biochemical methods and the yeast two-hybrid system for detecting physical interactions *in vivo*. A procedure for a two hybrid-system positive control, necessary for functional testing, is being developed and refined.

Differential Regulatory Response for the Δ9 Desaturase in *Saccharomyces cerevisiae* Based on

Unsaturated fatty acids (UFAs) regulate the expression of *OLE1*, the gene encoding the Δ9 desaturase in the yeast *Saccharomyces cerevisiae*. Previous work has demonstrated that the transcription factors Mga2p and Spt23p are required for *OLE1* expression, and that differential processing controls their activity. We have examined how the structure of unsaturated fatty acids and environmental conditions affect the processing of Mga2 and Spt23p and control the regulation of

Fatty Acid Species and Membrane-Altering Conditions

Matthew Ochs
Mentor: Dr. Virginia McDonough
Department of Biology

OLE1. We have found that yeast grown in UFAs 16:1Δ9, and 18:2Δ9,12 strongly repress transcription of *OLE1,* while 18:1Δ9 and 17:1Δ10 had a lesser effect in a wild-type strain. We also examined how these exogenous UFAs control the processing of Mga2p and Spt23p in wild-type yeast. We have found that cells grown in 17:1Δ10, and 18:2Δ9,12 have all of the Spt23p protein in inactive form, while the other growth conditions Mga2p and Spt23p can be found in both the active and the inactive form.

Response of *Neotyphodium* in Culture to Plant Hormones and Physical Damage

Lydia Pagel
Mentor: Dr. Thomas Bultman
Department of Biology

This research was supported by a grant NSF-IOS #1119775 from the National Science Foundation.

Neotyphodium coenophialum is a fungal symbiont of *Lolium arundinaceum* (tall fescue) that is thought to increase the herbivore resistance of grasses it infects by producing defensive chemicals such as alkaloids. The production of alkaloids such as lolines by the fungus is an inducible response to herbivore damage, but it is not understood how the fungus "knows" when the plant is being damaged. In an effort to discover whether the fungus is responding to plant hormones or damage to its own hyphae, I cultured *N. coenophialum in vitro* and exposed it to physical damage to its hyphae or to an application of salicylic acid, methyl jasmonate, 3-indoleacetic acid, gibberellic acid, or water. I collected samples from these cultures before the treatments, 1, 3 and 10 days after treatments. I analyzed the amount of mRNA from the lolC1 gene (for lolines) in these samples using RT-PCR. I found that the lolC1 gene is not expressed in culture. Thus, I plan to explore the other 7 genes involved in loline biosynthesis to see if any of them are expressed in culture.

Comparison of Water Lines and Water Troughs: Effects on Gut Microbiology and Water contamination

Amanda Porter, Alexis Meelker, Erin Alenciks, and Kelly Frazier
Mentors: Dr. Aaron Best and Dr. Gregory Fraley
Department of Biology

This research was supported by Maple Leaf Farms, Inc.

Controversy has developed over the last few years as to whether or not water nipple lines or water troughs are more appropriate for Pekin ducks in grow-out commercial barns. We hypothesized that duck caecal samples and water samples from barns utilizing a water trough delivery system would contain a larger diversity of bacterial, and potentially more harmful bacteria. We also hypothesized that duck health, as reflected by caecal composition, would be significantly different in water trough conditions compared to water lines. Ducks were divided into 4 pens per barn (n = 1000 ducks/pen), with each barn containing a different water delivery system. Water samples were taken every three days and duck caecal samples were collected on days 5, 21, and 33. It was found that ducks in water line conditions did not have significantly different caecal compositions from ducks in water trough conditions, and water sample compositions did not significantly affect ducks in either treatment. Water samples from each delivery system were significantly different from one another throughout the grow-out time period. The amount of bacterial diversity in water trough conditions was much higher than in water line conditions. Water troughs also contained an increased number of possibly pathogenic bacteria that may be harmful to both humans and ducks..

Patterns of DNA Sequence Variation in Plastid Genomes of Species Pairs between Eastern Asia and

There exist some species pairs between major continents such as alligators and tulip trees between eastern Asia and eastern North America, and the intercontinental sister species were derived from a common ancestor and separately evolved generating morphological differences and genetic disparities. However, it is unclear about patterns of the disparity between the species at the genome level; for example, are the differences present mostly in introns,

Eastern North America: An Example From Tulip Trees (*Liriodendron*)

Mark Stukel
Mentor: Dr. Jianhua Li
Department of Biology

intergenic spacers, or protein coding genes? Are there positive or negative selections on certain genes between the two sister species living in different habitats? In this study we obtained plastid genome sequences from multiple individuals of the two tulip trees: *Liriodendron tulipifera* in eastern North America and *L. chinense* in China, and examined differences between the two species in various protein coding genes, introns, intergenic spacers, and ribosomal DNAs. Information from the comparative genomic analysis between the species pairs may shed light on the association of changes at gene level with adaptations to their environment.

This project is supported by the Michigan Space Grant Consortium.

Indirect Relationship between Herbivores as Mediated through Endophyte-Containing Plants

Miranda Ulmer
Mentor: Dr. Thomas Bultman
Department of Biology

Fungal endophytes are a key aspect to the defense mechanism of many grasses, and it is their production of alkaloids that has been shown to inhibit herbivory. Up until this point, studies of this kind have primarily been focused on the effect endophytes have upon herbivores. There is a whole breadth of knowledge still to be discovered pertaining to the reciprocal effect, that of the effect of the herbivore on the endophyte. Here, we tested if horse (*Equus ferus caballus*) saliva has an effect on alkaloid levels produced by endophytes within Tall fescue (*Schedonorus arundinaceus).* In order to determine the biological activity of our treatment groups, a bioassay was performed, using aphids (*Rhopalosiphum padi L)*, and a loline analysis was carried out as well. We found that the infected plants supported fewer aphids than uninfected plants. Saliva caused an increase in aphid survival for the uninfected plants, and the opposite was true for infected plants. To further our results, we intend to perform an ergot chemical assay. Analysis of these results will hopefully give us more insight into the insect-fungus interaction.

Factors Influencing the Reproductive Success of Three Cavity-Nesting Birds: Eastern Bluebird (*Sialia sialis*), Tree Swallow (*Tachycineta bicolor*), and House Wren (*Troglodytes aedon*)

Victoria Underhill
Mentor: Dr. Kathy Winnett-Murray
Department of Biology

Because of the Eastern Bluebird's history of decline, it is important to understand how to manage the current populations by understanding what factors influence the reproductive success of the species. The objective of this study was to test the effect of species-specific nest-site occupancy and competitive interactions among species on the reproductive success of Eastern Bluebirds (*Sialia sialis*), Tree Swallows (*Tachycineta bicolor*), and House Wrens (*Troglodytes aedon*) using nest boxes. Nest box data were collected from May through August in 1992, 1994, 1995, 1997-1999, 2001-2003, 2005, 2007, 2008, and 2010-2013 at the Consumer's Energy J.H. Campbell Complex in West Olive, Michigan. Overall, reproductive success was greater when a particular species was using a box that was previously used by the same species, as compared with success when using a box previously occupied by a different species. This effect was also evident when examining each species separately for the Eastern Bluebirds ($X=108.744$, $df=1$, $p<0.0001$), Tree Swallows ($X=195.687$, $df=1$, $p<0.0001$), and House Wrens ($X=100.756$, $df=1$, $p<0.0001$). Reproductive success also varied by species. House Wrens had the greatest reproductive success at 63.31%, followed by Tree Swallows (59.52%), and Eastern Bluebirds had the lowest reproductive success (45.99%) ($F=3.283$, $df=2$, $p=0.047$). However, it was not determined in this study what caused this difference. For continuing studies, it could be worthwhile to examine the effect of surrounding topography on the reproductive success of the occupant species. It also may be worthwhile to examine the relationship of the

presence of mammals in neighboring boxes and the reproductive success of the occupant species.

Genome-Wide Analysis of Fundamental Transcription Factors in *Giardia lamblia*

Andrew Valesano, Lisa McLellan, and Ross Nickels
Mentor: Dr. Aaron Best
Department of Biology

Giardia lamblia is a unicellular parasite of the mammalian intestinal tract and is the most common parasitic intestinal disease in the United States. *Giardia* is an early-diverging eukaryote characterized by a two-stage life cycle. *Giardia* lacks the canonical RNA polymerase II transcription apparatus of eukaryotes and Archaea; its genome lacks TFIIB and has a highly degenerate TBP, raising questions as to how *Giardia* initiates RNA polymerase II transcription. We hypothesize that giardial BRF (TFIIB-related factor) could be substituting for TFIIB by playing a dual role in RNAP II and III initiation. Gene expression data from three time points in the giardial life cycle were generated using RNA-seq. Only a small subset of genes showed significantly different expression. Comparison with recent proteomic studies suggests limited regulation at the transcriptional level, giving way to post-transcriptional regulation as the primary control of gene expression, though continued study is necessary to test this hypothesis. Investigating transcription in *Giardia* will provide insight into the evolution of complex transcription systems in eukaryotes.

This research was supported by the Arnold and Mabel Beckman Foundation, the American Society for Microbiology, and National Science Foundation MRI Awards #1229585 and #1335890.

Resistance is Phutile - Using Host Cell Mutants to Advance Our Understanding of Phage Gene Function

Wessel VanDenBergh, Gloria Chang, Michelle Boerigter, and Kylie Jacobs
Mentors: Dr. Virgina McDonough and Dr. Joseph Stukey
Department of Biology

Mycobacteriophages are viruses that infect members of the bacterial genus *Mycobacterium*. With over 330 mycobacteriophage genomes sequenced and available in GenBank, they are the largest collection of sequenced phages that infect a single host (*Mycobacterium smegmatis*). Comparative genomic analysis reveals that mycobacteriophages are very diverse with more than 25 genetically distinct "types." Collectively, they possess numerous genes that encode novel proteins that have yet to be studied. Some of these novel proteins are predicted to have a role in targeting critical host cell processes during phage infection and promoting new phage production. To identify phage genes that may target critical host cell processes, individual genes or small genomic segments containing only a few genes were expressed in *M. smegmatis* and effects on cell growth (cytotoxicity) were observed. Using this approach, we have identified several cytotoxic genes or gene segments in two genetically unrelated phages, Vix (gene or gene segments: 65-66, 68-72, 80, and 87-88) and Pumpkin (gene or gene segments: 115, 119, 142 and 143). In an effort to identify relevant host cell targets, we have initiated a genetics approach and present here our initial characterization of spontaneous and chemically induced mutant strains of *M. smegmatis* that are resistant to specific cytotoxic phage genes. We reason that at least some of the resistant *M. smegmatis* strains will have mutations in the genes that are the targets of the mycobacteriophages. Subsequent identification of the mutated host cell genes will provide important information on the nature of the interactions involving mycobacteriophages and their host, *M. smegmatis*.

New Modes of Initiating Cation Radical Cycloaddition Dimerization and Polymerization Reactions

Brianna Barbu, Eun Jung Shin, Eric Webb, and David Green
Mentor: Dr. Jason Gillmore
Department of Chemistry

We are reinvestigating the work of Bauld and coworkers with respect to cation radical cycloaddition polymerization and dimerization. Bauld's most easily oxidized monomers provide suitable substrates for testing our group's novel photochromic photooxidants' abilities to gate sensitivity to photoinduced charge transfer initiation of cation radical reactions of materials interest. For instance, *N*-3-bis-(*trans*-1-propenyl)carbazole should be able to be photooxidized by the long-wavelength isomer of our quinazolinespirohexadienone photochrome. Revised synthesis of Bauld's monomers and a comparative study of their initiation by chemical oxidants, direct electrochemical oxidation, conventional photooxidants and our novel photochromic photooxidants will be reported.

This work was supported by the National Science Foundation under Career Grant CHE-0952768.

Parameterization of Fluorescent Protein Chromophores

Dalton Blood
Mentor: Dr. Brent Krueger
Department of Chemistry

Fluorescent proteins (FPs) are important to many studies of protein function, and we plan to examine them in the future using molecular dynamics (MD) simulations. Before running MD, fluorescent protein chromophore parameters must be determined that are consistent with the Cornell et al. force field (1995, J. Am. Chem. Soc.) and its variants (ff99, ff99SB, ff99bsc, ff14SB, etc), along with the generalized AMBER force field (GAFF; Wang et al., 2004, J. Comput Chem.) commonly used in AMBER. Parameterization was carried out using quantum mechanical calculations to determine the optimized geometry and electrostatic potential of each chromophore. The restrained electrostatic potential (RESP) charge fitting procedure was used to derive atomic charges. All other parameters (Lennard-Jones, bond length, bond Angle, dihedral interactions) were assigned by analogy to pre-existing force field parameters. Complete MD parameters are presented for the chromophores of six common FPs: EGFP, mCherry, DsRed, EBFP, EYFP, and ECFP.

This research was funded by NSF- RUI award #CHE-1058981, and computational resources were provided through NSF-MRI award #CHE-1039925 through the Midwest Undergraduate Computational Chemistry Consortium (MU3C).

Incorporation of Boronic Acids in Cross-Coupling Reactions Proceeding through C-C Activation

Joseph Dennis, Chad Compagner, and Connor McNeely
Mentor: Dr. Jeffrey Johnson
Department of Chemistry

Continued exploration of the rhodium-catalyzed intramolecular carboacylation of quinolinyl ketones and tethered alkenes has prompted the investigation into intermolecular cross-coupling reactions. Proceeding through a similar intermediate generated from C-C bond activation, a variety of rhodium catalysts, directing moieties, and boron transmetallating reagents were screened in pursuit of the selective activation and functionalization of substituted ketones. Apart from investigating the functional group tolerance of the reaction, current work is being done to optimize reaction conditions as well to develop facile sp^2-sp^3 cross-coupling pathways of ketones with alkyl boron reagents.

This research was supported by the Camille & Henry Dreyfus Foundation, Inc. and the National Science Foundation (CHE-1148719).

Promoting Catalysis and Expanding the Scope of

A new method for synthesizing ortho-substituted benzamides has been developed through the nickel-mediated decarbonylative cross-coupling of substituted phthalimides with various diorganozinc reagents. This reaction demonstrates broad substrate scope, including both electron-rich and electron-

Organometallic Nucleophiles Utilized in the Nickel-Mediated Decarbonylative Cross-Coupling of Substituted Phthalimides

Kimberly DeGlopper and Megan Kwiatkowski
Mentor: Dr. Jeffrey Johnson
Department of Chemistry

poor aryl phthalimide substituents and a variety of commercially available and in situ generated diorganozinc reagents. However, this reaction suffers from two key limitations. First, it requires a stoichiometric equivalent of nickel, which limits its application in synthesis. Second, diorganozinc reagents are either pyrophoric or must be synthesized in situ. Efforts to promote catalysis include altering the phthalimide substituent, ligand, solvent, and catalyst used. Recent work has also focused on expanding the scope of nucleophiles to include boronic acids, which are safer and more commercially available, while optimizing reaction conditions of this new system.

This research was funded by the National Science Foundation.

Developing Ion Parameters Using Shared GPU Accelerator Hardware

John Dood
Mentor: Dr. Brent Krueger
Department of Chemistry

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

Molecular dynamics (MD) simulations are used to model the structure and movement of macromolecules. The motion of finite particles is modeled by twice numerically integrating the forces on the atoms such as charge-charge interactions, van der Waals interactions using Lennard-Jones (LJ) potentials, Hookian bond length and angle interactions, and sinusoidal bond torsion interactions. Periodic boundary conditions (PBC) are used to approximate an infinite system of particles even though only a finite number are described. In many MD simulations water is simulated using a model with single van der Waals potential and mass. Additional detail is added through mass-less point charges that simulate the electrostatic properties (ESP) of the water molecule. TIP3P is the most popular simple water model. It includes a charge on the oxygen and the two hydrogens to give it a dipole moment. TIP4P-Ew is a popular water model that is similar to TIP3P but instead of having a charge on the oxygen atom it places a charge where the lone pairs would be. Another style includes TIP5P which has a charge for each lone pair, and a charge for each hydrogen atom. Recently, a new water model, OPC, has been developed that uses the same style of charge distribution as TIP4P-Ew and has results that compare better to experiment than the TIP4P-Ew model. For this new water model to be useful, LJ parameters must be developed for at least a few monovalent ions. This study looks into developing these parameters using MD simulations running on a time sharing computer cluster and GPU accelerator hardware. MD simulations running on entry level GPU hardware run around 1.5 times faster than on high end traditional computing hardware. This has allowed us to produce preliminary results that show first peaks of RDFs for a variety of Na^+ and Cl^- LJ parameters within the OPC water model.

Investigating the Presence of Heavy Metals in Tattoo Inks

Stanna Dorn and Jeffrey Hosmer
Mentor: Dr. Graham Peaslee
Department of Chemistry
Collaborators: Dr. Christine

Tattoos have existed for thousands of years; there is evidence that both the ancient Egyptians and the Iceman (both 5000 ybp) had tattoos. Historically, organic pigments were used in tattoo inks. However, recent tattoo methods have involved more brightly colored inks. One way to obtain brightly colored pigments is to take advantage of partially filled d-orbitals in the transition metals. Recent publications have indicated that these heavy metals are present in tattoo inks in concentrations that may lead to human health concerns. Chronic exposure to heavy metals can cause tremors, liver damage, memory loss, cognitive loss and possibly death. While there are no regulations for heavy metals in tattoo inks in the US, investigation of the prevalence of metals in the

Jaworek-Lopes, Emmanuel College, Boston, MA

This research was supported by the National Science Foundation (Grant No. NSF-RUI 1306074), and the U.S. Department of Energy (Grant No. DE SC0007352),

tattoo inks could lead to increased consumer awareness of potential health issues. To this end, over 140 commercial tattoo inks have been acquired and analyzed for the presence of heavy metals using three different methods: Scanning Electron Microscopy/Energy Dispersive Spectroscopy, Particle Induced X-Ray Emission, and Microwave Digestion/Inductively Coupled Plasma-Atomic Emission Spectrometry. Preliminary results indicate significant prevalence of copper, aluminum and titanium in the tattoo inks, as well as sporadic occurrence of other toxic metals such as lead, arsenic and barium.

Computational Chemistry Infrastructure, Interfaces, and Resources

Richard Edwards and Nathan Vance
Mentor: Dr. William Polik
Department of Chemistry

Computational chemistry is a fast-growing sub-discipline of chemistry with broad applications. Students and researchers can perform calculations using WebMO, a web-based interface to state-of-the-art computational chemistry programs. High-performance computer clusters are used for computationally intensive jobs. Less demanding calculations may be run with lower cost infrastructure, such as a server on a USB stick or the free WebMO iOS app. In addition, instructional resources are distributed with WebMO that fully describe its usage, including advanced and lesser-known features.

Trinuclear Ruthenium Acetate Clusters as Structural Disruptors for Aβ(1-42)

Morgan Glover
Mentor: Dr. Amanda Eckermann
Department of Chemistry

Alzheimer's Disease (AD) is a neurodegenerative disease that affects more than 5 million Americans, and is currently the 6th leading cause of death in the United States. The Aβ(1-42) amyloid protein is implicated in memory loss and degeneration of the brain in AD patients. The misfolding of this protein can cause it to oligomerize, form insoluble plaques, and interfere with normal neuronal activities in the brain. Previous researchers have shown that the short peptide KLVFFA inhibits the oligomerization of Aβ(1-42). We have designed a trinuclear ruthenium complex to incorporate a KLVFFAH ligand to target Aβ(1-42) and interfere with oligomerization. We have prepared several clusters of the formula $Ru_3O(OAc)_6(L_3)^+$, where L is a series of N-heterocycles. Further, previous work has found that insulin aggregates in a manner analogous to the Aβ(1-42) protein. We have investigated the effects of $Ru_3O(L)_3$ compounds on aggregation of insulin fibrils.

This research was supported by the Natural and Applied Sciences Division of Hope College.

Single-molecule Fluorescence Spectroscopy Using a Home-built Microscope

Timothy Hoffman, Sarah Jernigan, Christopher Davis, Andrew Cutshall and Derek Summers
Mentor: Dr. Brent Krueger

This research involves the design and construction of a confocal microscope for single-molecule fluorescence-detected resonance energy transfer (FRET) experiments. Many biological systems exhibit multiple conformations, and those of most interest may be very rare, such that typical spectroscopic techniques that average over many molecules are unable to resolve them. Single-molecule FRET avoids this averaging and allows structural variation as well as millisecond and slower timescale dynamics to be resolved. Donor and acceptor dyes will be attached to small biologically important molecules such as RNA, DNA, or protein. These samples will be used at low (femtomolar) concentrations, such that either zero or one molecule will be in the focal volume of the microscope at any given time. As the system passes through the focal volume it will be excited

Department of Chemistry

by the laser light. Detection of the corresponding fluorescence, originating from either the donor or acceptor, will allow calculation of the FRET efficiency. In this poster the design of a home-built single-molecule fluorescence microscope is presented along with early FRET data on multiple systems.

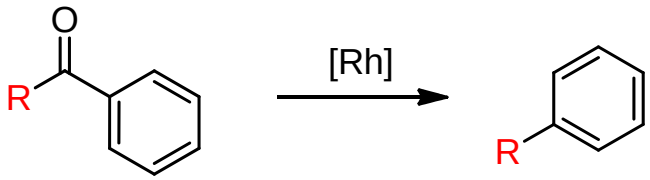
This research was funded by the National Science Foundation (NSF RUI #1058981).

The Effects of Directing Groups in Rhodium Catalyzed Decarbonylation Reactions

Caitlin Kozack and Cameron Pratt
Mentor Dr. Jeffrey Johnson
Department of Chemistry

This research was supported by the National Science Foundation (CHE-1148719).

The activation of carbon-carbon single bonds is a challenge due to the inherent strength of the bonds as a result of a lack of flexibility in the sigma bond and steric congestion that can occur around the bond. These bonds can be broken with the use of rhodium catalysts. A key reaction that can be carried out using carbon-carbon bond activation is the decarbonylation reaction. This occurs in the presence of both a rhodium catalyst and a nitrogen directing group. Herein we describe the synthetic pathways for starting materials, as well as the kinetic effects of various directing groups on the decarbonylation.



Exploring the Role of xCT in Neuroregeneration through Laser Ablation of Zebrafish Neurons

Nicole Ladd
Mentor: Dr. Brent Krueger[1], Dr. Leah Chase[1,2], and Dr. Aaron Putzke[3]
[1] Department of Chemistry,
[2]Department of Biology,
[3]Whitworth University
Department of Biology

System x_c^- is a heterodimeric amino acid transporter comprised of a light chain unit, xCT, which confers the transport specificity, and a heavy chain unit, 4F2HC, and has been shown to facilitate the exchange of intracellular glutamate for extracellular cystine. Within the cell, cystine is rapidly reduced to cysteine, the rate limiting reagent for glutathione (GSH) production. GSH is an endogenous reducing reagent that is an important in mitigating the oxidative stress that can develop within cells which, untreated, can trigger cell death. It has been shown that system x_c^- is strongly expressed in the central nervous system, particularly in activated neuroprotective cells such as astrocytes and glia. It is believed that relief of oxidative stress in the environment of neurons and their protective counterparts is critical in processes such as neuroregeneration, an ability unique to teleost fish, including zebrafish. Using this information, the thrust of the current study is to identify the role that xCT plays in neuroregeneration in vivo. To initiate neuroregeneration, we will use a femtosecond laser to perform ablation on zebrafish neurons. Confocal microscopy will be used to observe the trafficking of an xCT:GFP fusion protein during the neuroregeneration process.

This research was funded by the National Science Foundation (NSF RUI #0843564 and NSF RUI #1058981).

Particle Induced Gamma-ray Emission as a Rapid Detection Technique for Perfluorinated Compounds

David Lunderberg and Margaret Dickinson
Mentors: Dr. Graham Peaslee and Dr. Paul DeYoung
Departments of Chemistry and Physics
Collaborators: Dr. Jennifer Field, McKay Allred, and Alix Robel, Oregon State University

Recent studies have shown that perfluorinated compounds (PFCs), a broad class of chemicals used as powerful, long-lived surfactants in consumer products, are associated with human health hazards. Because of the environmental persistence of PFCs, their ability to bioaccumulate, and their suspected human toxicity, new methods to identify these chemicals in consumer products are needed. Current detection techniques include liquid chromatography-tandem mass spectrometry (LC-MS/MS), a costly procedure in both time and resources. Particle induced gamma-ray emission (PIGE) is an established ion beam analysis technique that has been used to quantitatively measure light elements in diverse target materials. PIGE utilizes a beam of accelerated protons to excite ^{19}F nuclei in a target. As these nuclei return to their ground state, they emit characteristic gamma-rays that can be used to quantify the fluorine concentration in a sample. In this study, an in-air PIGE methodology has been established as an effective tool to determine the presence or absence of PFCs used as coatings in consumer products including papers, carpets, and textiles. The two goals of this project are to (1) establish PIGE as an effective technique for PFC analysis and (2) disseminate this technique with other laboratories to make cheap and efficient analysis of PFCs in consumer goods and the environment.

This research was supported by the National Science Foundation (Grant No. NSF-RUI 1306074), the Department of Energy (Grant No. DE-FOA-000448), and the Hope College Department of Physics Guess Research Fund.

Preparing for Harvesting Radioisotopes from FRIB

Boone Marois
Mentors: Dr. Aranh Pen and Dr. Graham Peaslee
Department of Chemistry
Collaborators: Dr. Suzanne Lapi and Tara Mastren, Washington University in St. Louis

This research was supported by the U.S. Department of Energy (Grant No. DE SC0007352).

The Facility for Rare Isotope Beams (FRIB) will be a new national user facility at Michigan State University (MSU) and funded by the Department of Energy Office of Science Office of Nuclear Physics (DOE-SC). FRIB will have the ability to accelerate uranium to 200 MeV/nucleon. Many long-lived, rare isotopes will be generated at FRIB that could potentially be harvested for off-line use. This study will use current conditions at the National Superconducting Cyclotron Laboratory (NSCL) to determine the production and extraction yields of four radioisotopes: ^{24}Na, ^{67}Cu, ^{48}V, ^{85}Kr. All of these radioisotopes will eventually be collected in an aqueous beam dump at FRIB. A water target apparatus has been constructed at Hope College that replicates the collection of isotopes in an aqueous beam dump. Modeling of the nuclear reactions at NSCL and subsequent decay products was done using two programs, LISE++ and Nucleonica. The information from these programs is being used to streamline the isolation and extraction procedures for the radioisotopes of interest from the aqueous beam dump at FRIB. ^{24}Na and ^{67}Cu have already been successfully harvested using a purified beam (~75% ^{67}Cu) at the NSCL. Preliminary results from a revised extraction procedure and end station modifications will be presented to describe the successful harvesting at the NSCL from a more intense, less purified beam (~3% ^{67}Cu).

A Framework for General Chemistry Laboratory Design and Evaluation

Sarah Mattioli

The Department of Chemistry at Hope College has a history of leading the nation in chemistry education with an emphasis on integration of research experiences into undergraduate education. Research into effective qualities of a General Chemistry Laboratory experience have emphasized the structured inclusion of research-like experiences, guided inquiry, as well as professional skills into the curriculum. Hope College has endeavored to include proven new teaching

Mentor: Dr. Justin Shorb
Department of Chemistry

This research is based upon work supported by the Hope College Department of Chemistry.

methods such as peer review, real-world contextualization, and inquiry-based experiments into their curriculum as cohesively as possible. Here, a full literature review of recommended learning objectives will be presented, along with a meta-analysis to generate a useful rubric for evaluating the quality of any General Chemistry Laboratory curriculum, followed by its application to Hope College's own Chemistry 127 & 128 sequence. Highlights of this project include a breakdown of the strengths of our current curriculum as well as research-guided avenues for improvements with subsequent iterative evaluation. At the heart of this research is the creation of a framework for both design of new laboratories and evaluation of curricula that can be applied universally to any existing program to aid in the incorporation of effective pedagogies. The transferability of this generic iterative framework for improving laboratory curriculum to other institutions will be discussed.

Computational Modeling of Next Generation Quinazolinespiro-hexadienones for Application as Photochromic Photooxidants

Lauren Messer
Mentor: Dr. Jason Gillmore
Department of Chemistry

Our group's ongoing research program focuses on designing more reducible analogs of the perimidinespirohexadienone (PSHD) photochromes as potential photochromic photooxidants capable of gating the molecules' ability to initiate photoinduced charge transfer reactions for possible materials applications. Replacing the naphthalene moiety of the PSHDs with a quinoline moiety gives the quinazolinespirohexadienone (QSHD) family of photochromes whose synthesis, photochemistry, and electrochemistry we have recently reported. In this work we describe recent computational efforts on the MU3C cluster to design even more electron deficient QSHD analogs capable of gating PICT and photooxidizing less reducible monomers of interest to materials applications. We report computed reduction potentials based on our present methodology and investigate application of our newly reported methodology to photochromes. We also use bond order, bond length and molecular orbital calculations to predict the likely direction of spirocyclic ring opening for these asymmetric photochromes.

This work was supported by the National Science Foundation under grants CHE-0952768 and CHE-1039925, by the Camille & Henry Dreyfus Foundation through a Henry Dreyfus Teacher-Scholar award, and by a Schaap Research Fellowship from Hope College.

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

Erik Phipps, Janelle Kirsch, and Caroline Gregerson
Mentor: Dr. Jeffrey Johnson
Department of Chemistry

Intramolecular alkene carboacylation has previously been achieved under rhodium catalysis using quinolinyl ketones. Utilizing insight gained from mechanistic studies, a series of new quinolinyl ketone substrates containing *ortho*-substitution have been prepared and subjected to rhodium catalysis in the presence of an exogenous alkene. This poster provides an overview of substrate synthesis as well as the unexpected product. Rather than the anticipated reaction sequence, these substrates have been observed to undergo carbon-carbon bond activation followed by conjugate addition to Michael acceptors.

This research was supported by the NSF.

Diaminoacenaphthylene, a Key But Elusive Intermediate toward

We are working to develop a new class of photooxidants based on organic photochromes that would add an additional level of gating to the process of photoinduced charge transfer (PICT) initiation of cation radical reactions with relevance to a variety of materials applications. Photochromes

Carbonyl-Substituted Perimidinespirohexadienone Photochromes

Amber Prins
Mentor: Dr. Jason Gillmore
Department of Chemistry

This work was supported by the National Science Foundation under Career Grant CHE-0952768.

with long wavelength isomers (LW) capable of acting as photooxidants but with short wavelength isomers (SW) less capable of doing so are sought. This necessitates photochromes that revert only thermally and that have excited state reduction potentials that are more positive for LW than for SW. (As the difference in excitation energies is in the opposite direction, this requires a very large difference in ground state reduction potentials!) The parent perimidinespirehexadienone (PSHD) photochrome meets these basic requirements, but with a very modest difference in excited state reduction potential between SW and LW, thus with minimal capacity for gating, and very modest photooxidizing power. Based on computationally predicted reduction potentials, carbonyl-substituted PSHDs are promising synthetic targets for increasing the difference in reduction potential between SW and LW and for making LW a far more potent photooxidant. Previous experimental results show that it is not possible to add carbonyls to the photochrome's naphthalene "bottom" before coupling. Thus, it will be necessary to prepare an acenaphthylene-bottomed PSHD. This requires the synthesis of diaminoacenaphthylene. This seemingly simple molecule has proved very difficult to make. After ruling out the most straightforward syntheses and the use of protecting groups, we now detail our current synthetic routes toward this challenging intermediate.

Fun in the Sun with *Escherichia coli*: Environmental Adaptation and Viability

Megan Munger, Luke Ragon, Roudeland Metellus, Brandy Mullen, Shaylyn Pritchard, and Josh Welsch
Mentors: Dr. Aaron Best and Dr. Michael Pikaart
Departments of Biology and Chemistry

Bacteria of fecal origin present a health risk when present in bodies of water used for recreation. These organisms may be reduced in number when exposed to sun - a process known as insolation. The survivability of fecal indicator bacteria, specifically *E. coli*, of lab, environmental, and fecal isolates was examined. Bacterial cultures were made of all isolates then pipetted into polyethylene bags. The bags were placed outside in direct sunlight for up to three hours. Samples were removed from insolation in forty-five minute intervals and spread on plates to evaluate cell viability. *E. coli* counts decreased markedly with sun exposure and were completely inactivated after the full time period. There were clear differences in the survivability of each strain. The laboratory strain died most rapidly whereas the fecal isolates proved to be hardy and consistently decayed slower than most of the environmental isolates. These findings suggest that the environmental *E. coli* strains may not be better adapted to solar radiation than fecal isolates.

The Synthesis and Examination of Bridged Oligothiophenes as Small-molecule Semiconductors in Organic Photovoltaic Devices

Lisa Savagian
Mentors: Dr. Peter Skabara and

Organic photovoltaic devices (OPVs) have been a centerpiece of solar power research due to their low-cost fabrication and minimal environmental impact. Recent advancements in synthetic chemistry have enabled the tuning of organic semiconductor functionality at the molecular level, thereby enhancing device specificity and increasing OPV efficiency to levels approaching those required for commercial success. Specifically, oligothiophenes have been widely studied and demonstrate viability as charge transport materials in OPVs. The present study reports the synthesis of a novel family of bridged oligothiophenes with methyl-capped terthiophene, quinquithiophene, and septithiophene backbones for application in OPV devices. The structures were studied with UV-Vis spectroscopy, cyclic voltammetry, and tested for OPV performance in bulk heterojunction solar cells. Successful photocurrent generation was observed for

Dr. Neil Findlay
Department of Pure and Applied Chemistry, University of Strathclyde (Glasgow, UK)

This research was made possible by the American Chemistry Society IREU Program and funded by the NSF

devices fabricated with a donor-acceptor mixture of the terthiophene analogue and PC70BM. A ten-fold increase in power conversion efficiency was attained through the optimization of solution-processing parameters. Meanwhile, the septithiophenebackboned analogue exhibited more desirable optical and electrochemical properties than its terthiophene and quinquithiophene counterparts. However, its tendency to aggregate resulted in non-uniform film morphology, impeded charge transport, and prevented successful photocurrent generation. Improvements in the processability of bridged oligothiophenes are needed to best exploit the properties of these unique organic semiconductors.

Trifluoromethylation of Model Aryl Halides (toward bistrifluoromethylquinazolinespirohexadienone)

Jessica Scott
Mentor: Dr. Jason Gillmore
Department of Chemistry

Our computational studies predict that replacing the methyl groups in our previous generation dimethylquinazolinespirohexadienone (QSHD) photochrome will make for a much more potent photochromic photooxidant. A previous group member determined that it is not possible to carry out the synthesis with trifluormethyl groups present from the start as they completely inhibit a key nitration step. Meanwhile a current labmate has devised a synthesis of dihaloQSHD that could be amenable to installing the trifluoromethyls at a variety of points along the synthetic route. Five different options of when to perform this transformation are possible, replacing either a bromide or an iodide. I have undertaken model studies on four different aryl bromides and iodides to optimize trifluoromethylation conditions. The effects of competing reactions and inhibitors were studied through competition experiments. Together these allow us to identify the most promising targets for trifluoromethylation in the synthesis of the desired bis(trifluoromethyl)QSHD.

This work was supported by the National Science Foundation under Career Grant CHE-0952768, by the Camille & Henry Dreyfus Foundation by a Henry Dreyfus Teacher-Scholar award, and by a Schaap Research Fellowship from Hope College.

The Presence of Halogenated Flame Retardants and Heavy Metals Suggests Electronic Waste Recycling in Mardi Gras Beads

Meghanne Tighe
Mentor: Dr. Graham Peaslee
Department of Chemistry
Collaborators: Jeff Gearhart and Karla Peña, Ecology Center, Ann Arbor, MI

Gas Chromatography/Mass Spectroscopy (GC/MS), Scanning Electron Microscope/Energy Dispersal Spectroscopy (SEM/EDS), and X-ray Fluorescence (XRF) were utilized to detect halogenated flame retardants as well as heavy metals in Mardi Gras beads. XRF was the primary method of elemental detection and GC/MS allowed for the identification of specific flame retardants found within the beads. XRF spectroscopy revealed that the majority of beads had concentrations of bromine above 400 ppm and concentrations of chlorine above 3,500 ppm, suggesting widespread use of brominated and chlorinated flame retardants. XRF data also showed that over 64% of the beads had lead concentrations greater than 100 ppm, which is the U.S. Consumer Product and Safety Commission (CPSC) limit for lead in children's products. Several flame retardants which are known to originate from printed circuit boards and various plastic housings for electronics were found by GC/MS to be present in the beads. SEM/EDS identified silicon, aluminum and other typical e-waste constituents in most of the beads. The similar elemental compositions of Mardi Gras beads and e-waste indicate that significant recycling of e-waste into polystyrene beads is occurring.

This research was supported by the National Science Foundation (Grant No. NSF-RUI 1306074).

CHEMISTRY

Gadolinium-doped Hydroxyapatite Nanoparticles as Scaffolds for Multimodal Imaging

Anna Washburn, Daniel SantaLucia, Lauren Rechenbach-Chapman, and Regina Tan
Mentor: Dr. Amanda Eckermann
Department of Chemistry

Multimodal imaging agents are beneficial to medical imaging and research because they combine strengths of individual modalities. Nanoparticles provide an excellent scaffold to combine different imaging agents into one entity. Following a literature precedent, we have synthesized gadolinium-doped hydroxyapatite nanoparticles for magnetic resonance imaging. We have characterized these particles using SEM/EDS. Further, we have investigated modification of the surface of these hydroxyapatite nanoparticles using a phosphate-labeled dye. Current goals are to further characterize the size, structure, and composition of these nanoparticles.

Research funded by Division of Natural and Applied Sciences at Hope College.

Differential Photochromic v. Electrochromic Ring Opening of Quinazolinespirehexadienenones

Eric Webb, Kyndra Sluiter, Jonathan Moerdyk, Amy Speelman, and Benjamin Pollock
Mentors: Drs. William Polik and Jason Gillmore
Department of Chemistry

We are working to develop a new class of photooxidants based on organic photochromes that would add an additional level of gating to the process of photoinduced charge transfer (PICT) initiation of cation radical reactions. Photochromes with long wavelength isomers (LW) capable of acting as photooxidants but with short wavelength isomers (SW) less capable of doing so are sought. The parent perimidinespirehexadienone (PSHD) photochrome meet the basic requirements for such a system, but with a very modest difference in excited state reduction potential between SW and LW, thus minimal capacity for gating, and very modest photooxidizing power. Quinazolinespirohexadienones (QSHDs), PSHD analogs in which the naphthalene bottom has been replaced with a quinoline, are modestly more electron deficient and potentially more potent photooxidants. Our group has previously published QSHD synthesis and photochemistry, including the proof of direction of photochromic ring opening into the LW isomer. We have subsequently discovered that QSHD opens in the opposite direction upon one electron reduction to form a different electrochromic LW isomer. Computations of bond lengths, bond orders, and molecular orbitals help us rationalize these results.

This work was supported by the National Science Foundation under Career Grant CHE-0952768.

Nicole Ladd, Chemistry and Daniel Stevens, Chemistry, presenting at the Celebration, 2015.

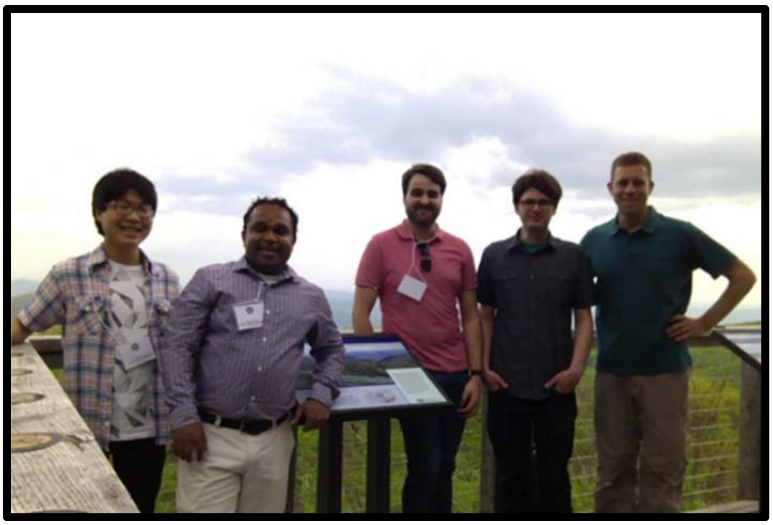
COMPUTER SCIENCE

Modeling Bacterial Metabolism and Genetic Regulation

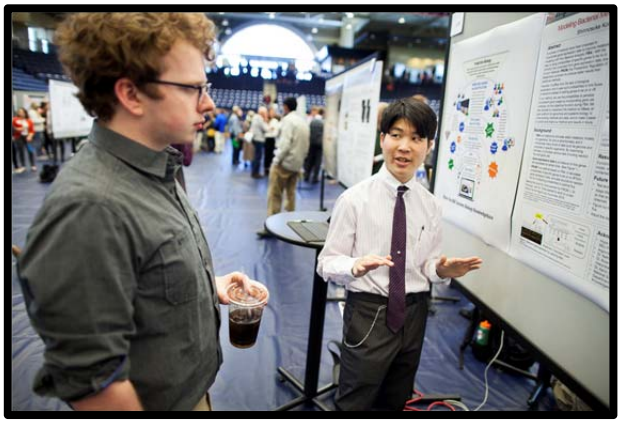
Shinnosuke Kondo
Mentor: Dr. Matthew DeJongh
Department of Computer Science

A number of methods have been proposed to incorporate gene expression data to improve metabolic modeling with Flux Balance Analysis (FBA). With the idea of using probabilities of specific genes to be on or off which are computed from gene expression data, one of such methods, PROM (the Probabilistic Regulation of Metabolism) is known to produce better results than traditional methods. However, it suffers from the lack of biological explanation why it uses such probabilities to limit fluxes of reactions instead of setting genes to be on or off. In our method, we use the probabilities to penalize inconsistent gene usage by incorporating gene use variables into the objective function during FBA. We also decided to implement the method on KBase, an open platform for genomics and systems biology, to utilize existing methods and data, and to make it easier to publish and share our method and results in future.

This research was supported by the National Science Foundation, Award Number 1330734.



Shinnosuke Kondo and Matthew DeJongh in the Blue Ridge Mountains for the COBRA 2014 conference.



Shinnosuke Kondo, Computer Science, presenting at the Celebration, 2015.

Designing Improved Light Responsive Actuators through Mechanical Testing and Materials Development

Ryan Backman and John Baranski
Mentor: Dr. Matthew Smith
Department of Engineering

Stimulus-responsive actuators allow for intelligent activation of systems, but often suffer from physical limitations like low mechanical work output. The objective of this study was to enhance the behavior of photoresponsive polymer strips through material and mechanical design. These materials were modeled in an arch geometry to study their ability to perform work through a "snap-through" motion which is activated in practice via a blue-green laser. Continuation and bifurcation software and commercial finite element analysis software were used to identify ideal aspect ratios for use in simulating this snap-through phenomenon. In addition, a test fixture was designed to measure blocking stress of irradiated samples of near infrared (NIR) responsive materials. Future work will consist of characterizing the absorbance and photostrains of this material based on its percentage of infrared active cross-linker.

This research was supported by the Undergraduate Fellowship Grant from the Michigan Space Grant Consortium.

Surface Stimulation as a Potential Treatment for Phantom Limb Pain

John Boss and Carson Tobias
Mentor: Dr. Katherine Polasek
Department of Engineering

This research was supported by the Hope College Dean for the Natural and Applied Sciences Office and a grant to Hope College from the Howard Hughes Medical Institute through the Undergraduate Science Education Program.

Phantom limb pain is a post-amputation phenomenon where an amputee experiences painful sensations in their missing limb. We hypothesize that by eliciting natural sensations in the missing limb; phantom limb may be reduced or eliminated. Nerves in both the upper and lower extremities were tested. Stimulation was applied to the median, ulnar, and fibular nerves on able-bodied subjects. The hand and foot sensation thresholds as well as the maximum stimulation were determined to define an optimal stimulating parameter space. Stimulation values within that area were tested at 50μs, 100μs and 500μs pulse widths, all at 25%, 50%, and 75% of the range between the hand and foot thresholds and maximum stimulation. An amplitude of 60% of the optimal stimulating parameter space was used while a combination of frequencies, burst lengths, and inter-burst lengths were varied in hopes of eliciting a natural sensation such as tapping or pressing. The type, magnitude, and location of sensation were recorded for each trial. A tapping or pulsing sensation was achieved in both the upper and lower extremity when the frequency was decreased to 1-4 Hz, while the different combination of burst lengths and inter-burst lengths did not result in a noticeable difference of types of sensation.

Structural Control of Civil Infrastructure Using Bio-Inspired Wireless Sensor Nodes

Ireana Cook
Mentor: Dr. Courtney Peckens
Department of Engineering

This research was supported by the Hope College Dean Start-Up Fund.

Aging, deterioration, and external loads, such as high winds and seismic excitation, continue to abate the condition of civil infrastructure. Active, semi-active, and passive structural control systems offer a means to mitigate these effects. Despite the considerable amount of research and implementation of data acquisition systems in structural control, the challenges of high energy costs, latency, restricting tethered systems, and unreliable wireless systems are still prevalent. A new, bio-inspired sensor draws from the mammalian auditory system using band pass signal filtering and high data compression capabilities allowing for low power, real-time processing and decentralized control. Despite the feats of this new high speed wireless system, communication issues still exist. Because of the real-time processing, high data transmission leads to a maxed out wireless channel. A potential solution is to eliminate extraneous data in packets by prioritizing information transmitted from each sensor. The 1940 El Centro earthquake signal was output to a four-story structure model and data was collected using the bio-inspired wireless sensors. Through an energy analysis of

12 filter sensors, the data showed filters 7, 3, 10, and 2 transmitted the highest energy signals and therefore, should be given higher priority. The corresponding frequencies of these filters are 4.9 Hz, 2.1 Hz, 7.0 Hz, and 1.4 Hz. These frequencies closely correlate with the natural frequencies, 1.3 Hz, 1.95 Hz, 4.8 Hz, and 6.83 Hz, of the four-story structure model. This validates the bio-inspired wireless sensors and allows for future work in sensor prioritization and extraneous data elimination.

Asphalt Recovery from Used Roofing Shingles

Gavin Donley and Delfino Hernandez
Mentor: Dr. Michael Misovich
Department of Engineering

This research was supported by Great Lakes Shingle Recycling.

Over eleven million tons of asphalt roofing shingles are discarded in the United States annually, and there is interest in separating asphalt from the other components of the shingles. Separations based upon dissolving asphalt in solvents and upon mechanical agitation in non-solvents at elevated temperatures were investigated. Agitation in boiling water and boiling propylene glycol was not effective in separating asphalt from other components, and produced suspensions of particles that were difficult to separate from the liquid. Asphalt solubility in five common organic solvents was tested, and toluene was selected by qualitative observation of the solutions and consideration of potential process hazards of tetrahydrofuran. Experiments were performed to quantify mass transfer in the solution process. Samples were taken as 1-6 g samples of shingles were stirred with 75-150 mL of toluene for 10-40 minutes. A colorimeter was used to determine the asphalt concentration. Stir rate, shingle particle size and type were also varied during testing. Analysis is ongoing, and the results will be applied in a preliminary process design for a large-scale process.

Modeling for Surface Stimulation of the Median Nerve

Kathleen Finn, Lane Heyboer and Julia Slopsema
Mentor: Dr. Katharine Polasek
Department of Engineering

Phantom Limb Pain, a pain or discomfort in the missing limb, is experienced by 50-80% of amputees. We hypothesize that by eliciting a "real" sensation in the phantom limb; phantom limb pain may be reduced or eliminated. Previous studies with single electrodes placed at the elbow produced sensation in a portion of the hand and the area increased with increasing stimulation. The objective of this study was to develop a computer model of surface stimulation that can be used to predict the effect of electrode location, size, and configuration on activation of the median nerve. A three-dimensional finite element model of the elbow was created using ANSYS Maxwell. The model was based on the anatomy of the arm and included electrical properties of the tissues including bone, muscles, blood vessels, tendons, and nerves. To validate the model, two 15x30 mm electrodes were applied to the skin of the model to match experimental conditions. Simulations were run on the model by applying a voltage across the electrodes. MATLAB and NEURON were then used to determine whether the axon fired for a given set of parameters. In order to improve the accuracy of the model, differences between motor and sensory axons were investigated. Ion channels were added to the nodes and internodes of the axons, and parameters were varied in order to distinguish motor and sensory axons. The thresholds at different axon diameters were found for the two types of axons to determine which type was activated first. The results were then compared to experimental results. Future work will include modeling an array of electrodes and developing an algorithm to control the stimulation to obtain partial activation of the nerve.

Thermally Reversible Gels for Fabricating Self-Oscillating Structures

Skylar Heidema
Mentor: Dr. Matthew Smith
Department of Engineering

This research was supported by the Undergraduate Fellowship Grant from the Michigan Space Grant Consortium and by a grant to Hope College from the Howard Hughes Medical Institute through the Undergraduate Science Education Program.

Responsive hydrogels are a type of soft material made up of lightly cross-linked polymers that are highly hydrophilic and have the ability to respond to external stimuli. Thermally reversible hydrogels respond to a change in temperature and have the ability to exhibit either lower or upper critical solution temperatures where phase separation occurs. Self-oscillating hydrogels combine an oscillating chemical reaction with responsive hydrogels. In these gels chemical oscillations produced by the Belousov-Zhabotinsky (BZ) reaction lead to mechanical swell-deswell oscillations. These materials have the potential to be used as soft actuators, microfluidic pumps, or as a form of chemical energy harvesting.

A primary objective for our project is to improve on existing self-oscillating gel systems by synthesizing a new self-oscillating hydrogel material that has the ability to be easily patterned. The patterning property that is being explored can then be used to create a large array of synchronized oscillating gel patches, which in turn can be used to produce large cooperative and complex motion. Thermal reversibility makes printing gels more controllable because the polymer solutions exhibit phase separation leading to gelation under certain conditions. Following procedures in the literature, a copolymer composed of acrylic acid and N-isopropylacrylamide was synthesized and successfully displayed gelation above 35°C. Similarly, a copolymer that displayed a gelation below 25°C was also synthesized by a reaction of poly(allylamine) and potassium cyanate. The next step will be to chemically crosslink the gel to make it permanent and incorporate the metal catalyst for the BZ reaction.

Self-Oscillating Gels Catalyzed by Ruthenium-Poly(Vinyl Pyridine) (RuPVP) Metallopolymer

Minchul Kim
Mentor: Dr. Matthew Smith
Department of Engineering

Stimuli responsive polymer gels, in which a single stimulus (e.g. temperature, pH, etc.) causes a change in volume, have been a subject of intense interest for applications such as drug delivery and biological sensors. A periodic change in external stimulus is required for a gel to exhibit periodic oscillations. However, many biological systems maintain periodic oscillations under constant environmental conditions, converting chemical energy into mechanical work. Materials capable of emulating this biological behavior represent exciting opportunities for extending responsive behavior through energy harvesting and autonomous function. Autonomous oscillations can be achieved by the oscillating Belousov-Zhabotinsky (BZ) reaction within gels containing the BZ catalyst. When a gel containing a catalyst metal, such as ruthenium, is placed in a solution containing the BZ reactants (minus the Ru), the catalyst within the gel undergoes oscillation in its redox state. Due to the difference in the hydrophilicity of the polymer network at the Ru^{2+} and Ru^{3+} states, the gel displays swell-deswell oscillations. Currently used catalysts are either cost prohibitive or overly difficult to synthesize. To alleviate this problem, a facile, relatively inexpensive synthesis of ruthenium catalyst complex was attempted following previously reported procedures in the coordination polymer literature. Using readily available precursors, *cis*-Dichlorobis(2,2′bipyridine) ruthenium(II) and poly(4-vinylpyridine), RuPVP metallopolymer that successfully triggers BZ reactions was prepared. The catalyst was successfully immobilized in poly(N-isopropylacrylamide) to make hydrogels that capture chemical oscillations in the form of waves when placed in a BZ reaction solution.

ENGINEERING

Design and Characterization of Test Bed for Structural Control of Civil Infrastructure

Eric Lipon
Mentor: Dr. Courtney Peckens
Department of Engineering

This material is based upon work supported by the Hope College Dean for the Natural and Applied Sciences Office and the Hope College Engineering Department.

Civil infrastructure experiences heavy environmental impacts every day that can lead to failure. Earthquakes and high wind loads are especially detrimental to infrastructure and if not properly accounted for can lead to death and injury to anyone in use of the infrastructure. One way to help prevent failure is through structural control. Structural control uses dampers to provide a counteracting force to mitigate the effects of extreme weather loads and prevent failure. The damper is controlled by a microcontroller that processes information, such as velocity and displacement, from a wireless sensor that is attached to the infrastructure. A four-story shear structure and an Active Mass Damper (AMD) system were designed for use on a shake table that would simulate an earthquake. Experimental data was then collected from the structure by simulating an earthquake on a shake table and using accelerometers to measure the acceleration at each floor. A theoretical model was then fine-tuned to match the experimental characterization of the structure. Once the computer model was finalized, a control scenario using the AMD was simulated using a Linear Quadratic Regulator (LQR) algorithm, to ensure the parameters were correctly defined before the experimental testing. The results from the simulation indicate that the control from the AMD reduces the interstory displacement by a factor of 0.5 to 0.75 at each floor, which can reduce the chance of failure in civil infrastructure.

Robotic Echolocation Testbed

Xavier Wu and Palmer D'Orazio
Mentors: Dr. Miguel Abrahantes and Professor Mark Edgington
Department of Engineering

This research was supported by the Michigan Space Grant Consortium and Hope College Department of Engineering.

Prototype of the Mobile System for Echolocation Data-collection

A bat can identify its position within an environment using ultrasound chirps to perform echolocation. The biology of this process has been studied in depth, and engineers have applied ultrasound ranging in mapping and object detection. However, most engineered systems do not mimic bats, and there is still much to be understood about how a bat actually processes the echoes it hears. In this project, a mobile system was developed that can precisely and reliably carry out echolocation experiments (data collection) for later analysis. A Kobuki robot was used as a base unit, providing mobility and accurate odometry. Custom shelving and mounting hardware were designed for the robot to accommodate a laptop for controlling the robot, along with a Microsoft Kinect sensor and ultrasonic transducers for taking experimental measurements. A Python based software package was designed to provide simple control of the robot and its sensors. This software was designed to work within the Robot Operating System (ROS) framework, and includes high-level interfaces for controlling robot movement and for the simultaneous playing and recording of sounds. Each data-collection experiment consists of a sequence of movements and measurements that the robot should perform. A YAML based specification for representing experiments was developed, so that users can create and execute experiments with simple, human-readable text files. The system we have developed will make future data collection simple, allowing us to focus on the study and analysis of echo signals.

GEOLOGICAL & ENVIRONMENTAL SCIENCES

Correlation of Historical and Sedimentological Records from Goshorn Lake, a Small Lake in a Coastal Dune Complex of Lake Michigan

Oude Karadsheh, Nicholas Hubley, and Mitzi Carranza
Mentors: Prof. Suzanne DeVries-Zimmerman, Dr. Graham Peaslee and Dr. Edward Hansen
Departments of Geological and Environmental Sciences and Chemistry

Sand in lakes near coastal dunes has been used as a proxy for aeolian activity. It is important to use a sampling strategy maximizing the probability of encountering aeolian sand and minimizing the probability of encountering sand transported by fluvial processes or washed/slumped into the lake from the shores. To test this, lake sediments were collected from Goshorn Lake in Allegan County, Michigan. This lake abuts a Lake Michigan dune complex at one end, has a stream entering at the opposite end, and is subject to anthropogenic disturbances along its banks. Aerial photographs, building records, and a published oral history of the lake were used to reconstruct aeolian activity and anthropogenic disturbance over the last 76 years. This history was compared to sand concentration as a function of depth obtained by textural analysis of 12 Glew cores collected across the lake basin. ^{137}Cs analyses were used to identify the 1963 bomb peak as a temporal reference point. The least amount of sand occurs in the cores furthest from the dunes, closest to the stream. A few sand peaks, <20%, are present. Cores collected closer to the dunes are characterized by multiple sand peaks, between 20–80% sand in the lower to middle portion of the core. In the upper core portions, the upward decrease in sand begins before 1963, consistent with aerial photographs showing a decrease in dune activity after 1938. One Glew core recorded a spike in sand after 1963. Historical records suggest this can be correlated with major construction at that location and time period. Small sand peaks near the stream inlet may reflect fluvial flux increases while sand peaks near the lake margins can reflect increases in sand resulting from shoreline disturbances. Therefore, the majority of the sand in the lake sediments appears to be aeolian.

Hydrothermal Formation of Epidote in Felsic Compositions: Examples from Sweden and Northern Michigan

Audrey La Roche and Matthew Stark
Mentor: Dr. Edward Hansen
Department of Geological and Environmental Sciences

This research was funded by the Michigan Space Grant Consortium.

Hydrothermal epidote is widespread in granitic rocks but has been the subject of relatively few scientific studies. We used a scanning electron microscope and electron microprobe to study mineral assemblages and chemistry in epidotized hydrothermal zones developed along late joints and fractures in high-grade granitic gneisses from four quarries in Halland Province, Sweden; and in arkosic conglomerates rich in rhyolite clasts from the Centennial Mine in the Keweenaw Peninsula, Michigan. In Halland, epidote is associated with chlorite, prehnite, and the replacement of Fe-Ti oxides by titanite. In the Centennial Mine, epidote is associated with calcite, pumpellyite, titanite, and rare hydrogarnet. These assemblages are consistent with upper prehnite-pumpellyite to lower greenschist facies conditions. Zoning was observed in epidote grains from both localities and commonly occurs as polygonal zones within which Fe/(Fe+Al) is relatively constant but changes suddenly at the boundary. REE-enrichment in epidote occurs most commonly at the margins of grains or along fractures. Modal analysis shows an inverse relationship between the abundance of alkali feldspars and epidote, suggesting a replacement reaction in which Ca is added, and Na + K is removed by hydrothermal solutions. In the Centennial Mine, the source of Fe for epidote formation appears to be dispersed hematite in oxidized sediments, and magmatic Fe-Ti oxides may have played the same role in Halland. Epidote formation at the Centennial Mine is part of the ca1.06 Ga hydrothermal metamorphism and Cu mineralization in the Keweenaw Peninsula. Epidotization in Halland postdates the ca1.0 Ga Sveconorwegian high-grade metamorphism. Although there is scatter, the predominant direction of veins associated with epidote is NE-SW, the same direction as an extensional event of

inferred Late Carboniferous-Permian age recorded elsewhere in southern Sweden. Despite the difference in geological settings, epidotization in both areas displays common features which may be characteristic of low-grade hydrothermal alteration.

A Scheme for Evaluating the Impact of Development on the Geomorphic and Ecologic Process of Lake Michigan's Coastal Dunes

Jacquelyn Plowman
Mentors: Prof. Suzanne DeVries-Zimmerman and Dr. Edward Hansen
Department of Geological and Environmental Sciences

Recent changes to Michigan's Critical Dune Law initiated this study to create a science-based, public policy tool for evaluating a development's impact on the geomorphology and ecology of Lake Michigan's coastal dunes. These dunes are valued for their scenic beauty and diverse ecological communities. However, development pressures on them are increasing and the revised law requires that regulators consider the diversity, quality, and function of the dunes when reviewing Critical Dune building permits. Hence, our current scientific understanding of geomorphic and ecologic processes in the dunes was used to create this two-part decision-making flowchart. The first part evaluates a development's impact on the dune's physical processes in three categories: dune mobility, erosion by gravity, and pavement effects. The second part evaluates the change in the overall diversity of communities, changes in the composition of species making up a community, and changes in the connection between communities. Five development scenarios with different dune/ecology settings, house/road layouts and densities were evaluated. The amount of dune mobility, and, therefore, the amount of sand burial, especially in open dune areas, decreased with development. Ecologically, early pioneer and successional communities, including sensitive species, which are dependent on sand burial, were lost due to the resulting dune stability from development. Ecological changes in the back dunes were not as pronounced as these dunes have little to no dune mobility and are vegetated with near-climax to climax communities adapted to little to no dune mobility. The distance connecting similar ecological communities increased with development, very likely decreasing the likelihood of that community's existence. Overall, this scheme is useful for assessing the impact of one development scenario versus another in different coastal dune settings. This method also shows promise in providing a science-based public policy tool for managing the coastal dunes.

Photographic Measurement Of Sand Movement In Gigapixel Panoramas Reveals Short Term Variability in Geomorphologically Similar Lake Michigan Dunes

Kelsey VanEyl-Godin and Katherine VanZytveld
Mentor: Dr. Brian Bodenbender
Department of Geological and Environmental Sciences

We measured sand movement in open-sand environments exposed on the interiors of parabolic dunes at two sites along Lake Michigan: Saugatuck Harbor Natural Area (SHNA) and the Kitchel Lindquist Hartger Dunes (KLH). The SHNA site is a blowout at the nose of a stabilized, dissected, 11.5 m high parabolic dune 360 m from the beach with an axis bearing of 75 degrees. The KLH site is a 14 m high parabolic dune 400 m from the beach with an axis bearing 70 of degrees. We used web-hosted gigapixel panoramas of digital photographs to record and measure sand surface elevations relative to dune pins designed for photographic measurement (photopins). Error analysis based on geometric principles demonstrates that parallax errors can be non-trivial when measuring photopins photographed at close range, but maximum error drops to less than 5 percent for photos taken at 5 or more meters. SHNA saw average sand loss of 6.76 cm from 2012-2014, but sand movement was variable, with an average net loss of 13.46 cm in 2012-13 partially offset by a net gain of 6.83 cm in 2013-14, recorded at 103 photopins. In contrast, from 2013-2014 KLH saw a net sand loss of 18.80 cm measured at 39 photopins. The sites are 40 km apart so

they see similar large-scale storm patterns but different smaller-scale fluctuations in wind direction and strength. Even within a single site, sand movement is patchy, with accumulation and erosion occurring within a few meters. The observation during 2013-14 of net sand accumulation at SHNA, contemporaneous with sand erosion at KLH, shows that sand movement at similar dune sites likely responds to highly localized events and conditions, particularly vegetation on the upper parts of SHNA that promotes sand accumulation. Time-averaging of localized responses produces the observed broad regional similarities in dune morphology.

360° panorama of a parabolic dune at the Kitchel-Lindquist-Hartger Dunes Preserve, Grand Haven, Michigan, made from 351 photographs taken June 27, 2014. The ponded water shows the low point on the dune. Wind has removed sand down to the water table, and erosion has prevented vegetation from growing on the dune interior.

The Formation of Megacrysts in Migmatitic Amphibolites from Halland Province, Southwest Sweden

Stephanie Vincent
Mentor: Dr. Edward Hansen
Department of Geological and Environmental Sciences

This research was funded by a grant from the Michigan Space Grant Consortium.

The growth of large mineral grains (megacrysts) can be promoted by a fluid phase that allows for rapid diffusion. Hence, the presence of megacrysts in metamorphic rocks can be one indicator of the presence of a silicate melt or other fluid phase during metamorphism. We studied megacrysts of hornblende (Hbl), garnet (Grt), clinopyroxene (Cpx) and orthopyroxene (Opx) associated with both tonalitic leucosomes and melanosomes in mafic migmatites from the Stensjö Nature Preserve and the area around Björkasjö Lake. Both localities are in the Eastern Belt of the Sveconorwegion Orogen, Halland Province, Sweden. We mapped both localities and examined samples with a polarizing microscope and SEM-EDS. We did quantitative mineral analyses by WDS on an electron microprobe. Whole rock analyses were done by X-ray florescence at Actlabs, Ontario. When the host rock contains Hbl+Pl (plagioclase) +/- Cpx without Grt or Bt (biotite) the megacrysts are either Hbl or Hbl+Cpx. The compositions of the megacrysts are similar to compositions of the same minerals in the host rock. Plagioclase in inclusions within and immediately surrounding Cpx megacrysts can contain up to 46 % more Ab (albite) than Pl away from the megacrysts. When the host rock contains Hbl+Pl+Grt+Cpx without biotite the megacrysts are either Grt or Cpx. When the host contains Hbl+Pl+Grt+Bt the megacrysts are Opx. These megacrysts are surrounded by a reaction rim of Hbl+Qtz+/-Cpx+/-Grt, and Hbl in the rims has distinctly lower Ti and K_2O+Na_2O concentrations than in the host. The anhydrous megacrysts, (Cpx, Opx, Grt), probably formed by vapor-absent (dehydration) melting. The different kinds of anhydrous megacrysts formed by different melting reactions controlled by the chemistry and mineralogy of the original rock. Hornblende megacrysts may have formed by the retrogression of Cpx during crystallization of the melt. Alternatively they may represent water-assisted melting, without partial melting, by a concentrated brine.

MATHEMATICS

Engineering the Future Academies

Sherah Head, Michelle Ky, Randall Roux, and Marissa Smith
Mentors: Dr. Eric Mann and Professor Susan Brown
Departments of Mathematics and Engineering

This project was supported by a grant from the Michigan Space Grant Consortium.

Engineering the Future Academies was offered through a partnership between the Center for STEM Inquiry at Hope College and the Muskegon Area Regional Math and Science Center. Designed as a learning experience for high school students, as research and mentorship opportunity for STEM education and engineering majors, and as professional development for teachers, the summer academy immersed four student engineering design teams in a one-week on-campus challenge. Hope College engineering and education majors partnered with area teachers, tailored the curriculum, and assessed the impact of this experience on both teacher and student participants with respect to STEM attitudes, beliefs, and dispositions. Follow-up contact with participating high school students and teachers was conducted during the subsequent school year. A professional development session at the Math and Science Center will be held in the fall of 2015 for 20 additional teachers in which the original summer teachers and undergraduates will play a significant role in their continuing development as future STEM education leaders. We hope the Engineering the Future Academies becomes an integral part of Hope College's summer opportunities and contributes to ongoing national research efforts seeking ways to engage and retain students in STEM education programs.

Guiding high school students through a design activity.

SABR: Projecting MLB WARP for Prospects

Nathan Longfield
Mentor: Professor Jill VanderStoep
Department of Mathematics

One goal of Sabermetrics is the development of projection systems to predict future player success. Many advanced models have been developed, such as PECOTA from Baseball Prospectus and ZiPS from the Baseball Think Factory. Since teams want to invest, both monetarily and developmentally, into players who will return value, the ability to project how the players will perform is essential. Once players are in the majors for a few seasons they have established what their production level will most likely be. However, when a player is in the minors it is not as clear how they will perform due to differences in levels and leagues. Since prospects and players in their first years in the professionals demand lower pay and are under team control, the team can often garner greater value out of a player at a lower cost. Players are under team control for six years after achieving rookie status so it would be beneficial for a team to be able to project the player's value over those years so they can try to acquire prospects that should succeed and provide maximum value with minimal costs. Using both advanced metrics and scouts' rankings to combine the two schools of player evaluation, we developed models to project a player's average WARP (Wins Above Replacement Player) over their first six seasons when under team control.

The Emerging Indigenous Knowledge and Practices Implemented by Smallholder Farmers of Kibale District in Uganda

Catherine Namwezi
Mentor: Dr. Yew-Meng Koh
Department of Mathematics
Collaborators: John Tusiime, J.S. Bongyereire and Buye Ronald, African Rural University, Uganda

A study on actual and emerging indigenous knowledge and practices implemented by smallholder farmers was carried out in three sub-counties of Kibaale District in Uganda. Using the data collected from this study, we wish to:

- identify past and present practices used to enhance farm production and productivity
- determine the impact modern farming methods has had on indigenous knowledge
- determine the relationship between the desired and actual food production of smallholder farmers
- identify the cultural and religious practices associated with enhanced agricultural production and agro-ecosystem management among the farmers.

Summaries of several variables in the dataset will be presented and discussed. We will use inference from different statistical models to answer the questions listed above and conclude with an overall summary of our findings.

This research was supported by Uganda Rural Development and Training program.

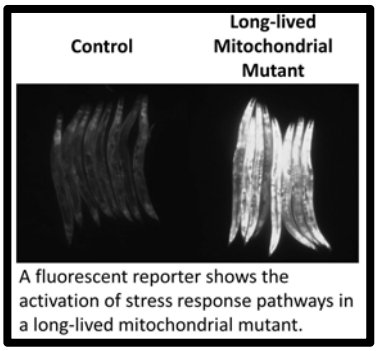
Above, Catherine Namwezi conducting research in Uganda, and below, presenting at the Celebration, 2015.

NEUROSCIENCE

Defining the Mechanisms Underlying Extended Longevity in *C. elegans* Mitochondrial Mutants

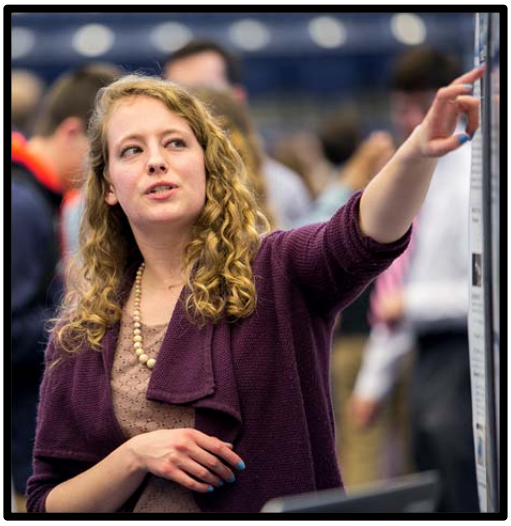
Claire Schaar
Mentor: Dr. Jeremy Van Raamsdonk
Center for Neurodegenerative Science, Van Andel Research Institute

This research was supported by the Frederick and Lena Meijer Student Internship Program.



A fluorescent reporter shows the activation of stress response pathways in a long-lived mitochondrial mutant.

Mutations affecting the function of the mitochondrial electron transport chain result in a long-lived phenotype in *Caenorhabditis elegans*. Recent work has shown that these mutations result in increased levels of reactive oxygen species (ROS). As it was previously thought that damage caused by high levels of ROS leads to aging, it is surprising that these mitochondrial mutants exhibit higher levels of ROS *and* an increased lifespan. Subsequent studies have shown that the higher levels of ROS in the long-lived mitochondrial mutants actually contribute to their increased lifespan. In this study, we sought to determine how the upregulation of stress response pathways and alterations in metabolism contribute to the longevity of three mitochondrial mutants:: *clk-1*, *isp-1*, and *nuo-6*. Using fluorescent reporters to visualize the activation of stress response pathways throughout the lifespan of the worm, we found that the mitochondrial unfolded protein response and the oxidative stress response are upregulated in all three mutants, while the antioxidant defense pathway is most upregulated in *isp-1* worms. Since mutations to the electron chain likely lead to a deficiency in energy production, it has been hypothesized that mitochondrial mutants may shift toward using glycolysis as a larger source of energy and that this shift in metabolism may contribute to their longevity. We examined the effect of using RNAi to knockdown the expression of *aldo-1*, a gene necessary for glycolysis, on the longevity of the three mitochondrial mutants. We found that *aldo-1* is required for the long lifespan of *isp-1* and *nuo-6* mutants but not *clk-1*. Overall, this work has provided additional insights into the roles of stress response pathways and metabolism in mitochondrial mutant longevity.


Lauren Gentry, Chemistry


Ireana Cook, Engineering and Jessica Burtka, Education

Bone Density Screenings Among the Diabetic Population

Alissa Boone
Mentors: Anne McKay ANP-BC, CCD[1], and Barbara Vincensi PhD, RN, FNP[2]
[1]Holland Hospital and [2]Hope College Department of Nursing

Diabetic osteoporosis is a metabolic bone disease that increases the possibility of fracture, secondary changes in bone tissue, decreased bone strength and increased friability. Osteoporosis is a health concern among the diabetic population that is currently under-screened and under-diagnosed. Dual-energy x-ray absorptiometry (DXA) is the gold standard measure of bone density. Implementing DXA screening for osteoporosis can help prevent fragility fractures. The purpose of this retrospective chart review was to describe the screening patterns of primary care providers, using DXA scans in the diabetic population. Dorthea Orem's Self-Care Deficit Theory was the framework of this study: Orem believed individuals should be self-reliant. Self-reliance is taken away from patients when fragility fractures occur. A convenience sample of 297 diabetic patients was identified from the databases of three primary care physicians in West Michigan. Data was analyzed using SPSS 19. Only 26% of females (≥ 65 years) and <1% of males (≥ 70 years) had DXA scans ordered with results interpreted. In conclusion, primary care providers need to increase rates of osteoporosis screening in their diabetic patients. The limitations included: patients selected were all from one practice, it was a convenience sample, patient's current medications were not considered, other comorbidities were unknown, and the sample was mostly composed of white females. The implications of this study for nurses is we need to educate our patients on the importance of secondary prevention methods such as DXA scans, as well as advocate for them to receive early screening.

Quality of Life in Patients with a Left Ventricular Assist Device (LVAD)

Pierce Bourgeois
Mentor: Dr. Susan Dunn
Department of Nursing

This research was supported by the Spectrum Health Transplant Team.

Heart failure (HF) is a debilitating disease that affects physical functioning and quality of life (QOL). A common procedure to increase QOL is the implantation of a left ventricular assist device (LVAD). HF patients are commonly included on the Interagency Registry for Mechanically Assisted Circulatory Support (INTERMACS) score which rates a patient's functioning status. The purpose of this study was to describe the correlation between a patient's functional status and their QOL before implantation and 3, 6, and 12 months after implantation in LVAD patients. Dorothy Orem's Self-Care Deficit Theory was used as the theoretical framework for this study because it focuses on a patient's self-care ability, which is diminished in HF patients. Data was collected by LVAD coordinators and nurses using the Kansas City Cardiomyopathy Questionnaire (KCCQ) before implantation and 3, 6, and 12 months after implantation. Demographic data, INTERMACS score, implantation device, and current status were also collected. This study took place in a large Michigan transplant clinic and had 127 participants. Analysis of data was completed using SPSS statistical software. Results show an increase of QOL from pre-implantation to 6 months after implantation. There is no statistical evidence of a correlation between a patients physical functioning and QOL, therapy, or gender. Limitations to this study included the small number of females in the study, one-site convenience sampling, and missing KCCQ forms. Nurses in the future can identify populations that are more likely to have a lower quality of life resulting from HF and assist them in improving QOL.

Effect of Pet Therapy on Patient's Anxiety in the Pediatric Emergency Department

Tara Hoover
Mentors: Cassie Patel, BS, CCLS, CPST[1], and Susan Dunn, PhD, RN[2]
[1]Helen DeVos Children's Hospital, [2]Hope College Department of Nursing

Pet therapy has been proven to decrease stress in the adult patient population, but little research has been done in the pediatric population. Study of pet therapy as an intervention for anxiety in pediatric patients in the emergency department (ED) is being done in a Michigan hospital. An additional study is being conducted to determine whether or not pet ownership impacts the effectiveness of the intervention of pet therapy for anxiety. The purpose of this proposed study is to determine what outside variables might have an impact on effectiveness of pet therapy, specifically if the patient has a pet at home. Florence Nightingale's Environmental Theory is the conceptual framework of the study. This theory states that elements of the environment directly affect health and care of the patient. The data collection method is an anxiety-rating tool and a patient characteristic sheet, developed by the researchers. Patients and caregivers will fill out the anxiety rating and the student nurses will collect the patient characteristic data verbally. Results will be calculated in p values with significance of less than .05 using SPSS software revealing the correlation between the state of pet ownership and the effectiveness of pet therapy intervention as evidenced by the decrease in anxiety rating between the pre and post rating of the patient and caregiver. Data will be collected from one Michigan hospital with a projected sample size of 72 participants. These participants are the patients and caregivers in for routine care to the ED. Results and conclusions of this study are not yet known. Anticipated limitations of the study are self-reporting anxiety ratings, convenience sampling and the tool lacking reliability and validity. Implications of this nursing research are revealing the underlying variables in the effectiveness of pet therapy and being able to use the results to best care for pediatric patients with anxiety.

Comparative Evaluation of the Pediatric Pressure Ulcer Prediction & Evaluation Tool (PPUPET) to the Braden and Braden Q Scales for Predicting Risk of Development of Pressure Ulcers In Pediatric Patients

Erin Jipping
Mentors: JoAnn Mooney, BSN, RN, CPN, CPPS[1], and Barbara Vincensi, PhD, RN, FNP[2]
[1]Helen DeVos Children's Hospital, [2]Hope College Department of Nursing

Preventing pressure ulcers in pediatric patients is essential to decrease costs and debilitating experiences. The purpose of this study is to compare the PPUPET, Braden Q and the Braden scales regarding sensitivity for predicting pressure ulcer development. The conceptual model used is Betty Neuman's Health Systems Model, which focuses on internal, external, and created environments that place patients at higher risk for a certain condition. A prospective study of 70 pediatric patients was done in a large teaching children's hospital in West Michigan to compare the PPUPET, Braden Q and Braden scales. For all patients, a skin audit and follow up chart review was conducted using the PPUPET and age appropriate Braden or Braden Q scale. These scores were then compared using a linear regression test and SPSS 19.0 for data analysis. Children on the units ages 18 and under were included in the data. Excluded were patients off the unit, those in the NICU, and those who refused the skin audit. Limitations include having data from only one site when there are several sites involved. The results showed that the PPUPET and Braden Q were more sensitive than the Braden. And, when compared, the PPUPET was more sensitive on audit day than the Braden Q. Nursing implications include finding the most sensitive scale, to provide nurses with a tool to use at the bedside and promote the best patient outcomes.

Leg Alignment in Beach Chair Position Yielding Optimal Outcomes in Shoulder Surgery Patients

Allie Jobes
Mentors: Susan Dunn, PhD, RN [1], Kristina Gryzbowski[2] and Connie Vander Boon[2]
[1]Hope College Department of Nursing, and [2]Spectrum Health

This material is based upon work supported by Spectrum Health South Pavilion.

Shoulder surgeries are routine in the orthopedic setting; however, patients report high pain intensity and interference with daily life postoperatively. There are no specific standards for positioning patients in a beach chair position during shoulder surgery, which may influence patient outcomes. Complications due to beach chair position have included neurologic, cerebrovascular and cardiovascular problems in recent studies. This study aims to describe patient outcomes in the beach chair position by comparing frog and straight-legged alignment. Leavell and Clark's Level of Prevention Theory provides the conceptual framework for the study because it emphasizes the importance of the nurses' role in primary prevention. The study consists of adult participants undergoing outpatient shoulder surgery. Once recruited and informed consent is obtained, the nurses will administer a McGill Pain Questionnaire in addition to the established preoperative assessment. Subjects will be randomly assigned to a group: frog or straight-legged beach chair. A nurse will repeat the McGill Questionnaire in addition to the standard follow-up assessment one day postoperative. The sample size is to be determined. Research will be conducted at an outpatient surgical center in West Michigan. SPSS statistical software will be used for analysis. ANOVA tests will be used to determine whether frog or straight-legged beach chair has on average a significant difference in pain intensity. Results and conclusions are pending. The study's small sample size, restrictive criteria for eligible participants and observation under only one surgeon limit the study's generalizability. It is anticipated that this research will launch future studies examining the nurses' role in positioning patients to reduce postoperative pain intensity and interference with daily activities.

Overall Quality of Life in Ventricular Assist Device Patients

Nora Kirk
Mentors: Jackie Iseler, RN, MSN, ACNS-BC[1], Karen Hadzic, RN, MSN[1] and Susan Dunn, PhD, RN[2]
[1]Spectrum Health, [2]Hope College Department of Nursing

Recent studies have shown increased use of ventricular assist devices (VADs) as a new pathway in the treatment of heart failure patients. VADs are used in patients waiting for heart transplant or as destination therapy. The purpose of this research was to examine patients' overall quality of life (QOL) based on their age and type of therapy. This research was done using Dorothy Johnson's Behavior System Model, in which the patient is a behavioral system and is capable of adapting to stressors effectively and efficiently. VAD coordinators and Intermacs-trained RNs had previously collected data in person, by giving patients the Kansas City Cardiomyopathy Questionnaire to complete before their implant, and then again post-implant at three, six and twelve months. This questionnaire was used to determine patients' overall QOL, as determined by a single numeric score. There were 84 patients, 13 females and 71 males, ranging in age from 19 to 80 years. Patients were drawn from a sample of heart failure patients either awaiting heart transplant or receiving the implant as destination therapy at a transplant clinic of a large hospital in Michigan. Independent t-tests were completed using SPSS software. Results include a higher mean age of patients receiving destination therapy. Conclusions regarding QOL based on age or therapy are insignificant. Limitations are a small sample size, a small number of females, and data collected from one clinic. Implications for future research include how nursing care can be adapted for these patients to help improve their QOL.

Platelet Transfusion Guidelines Development and Implementation in a Pediatric Hematology/ Oncology Population

Carly Mast
Mentors: Karen J. Vander Laan, PhD, MSN, RN[1], Renita Kuiper BSN, RN, CPHON[2], Lisa Hovingh, MSN, PNP, CPON[2], Lynn Stachel MSN, RN, CPON[2], and Susan Dunn, PhD, RN[3]
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The threshold for transfusing platelets in the pediatric hematology/oncology population is not standardized, resulting in potentially inappropriate transfusions. Consequently, patients can be unnecessarily exposed to foreign antigens or infection, the donor platelet supply could be depleted, and organizations may experience unnecessary costs. These problems can significantly impact patient safety, quality of care, and healthcare costs. The objective of this project is to survey providers regarding their current practice in prophylactic, pre-procedural, and therapeutic platelet transfusions. This project exists within a greater evidenced based initiative in which guidelines detailing thresholds to transfuse platelets will be implemented into practice. The impetus for the larger project included an internal study that showed platelet transfusions given at a median count of 22,000; much higher than many institutions. A literature review reinforced a critical need to standardize platelet transfusions. This review also revealed the existence of an established questionnaire regarding institution platelet transfusion practices and algorithms that direct appropriate times to transfuse. The steps of this project are being guided by the institution's Channels for Change Framework, based on the Iowa Model for Evidence-Based Practice. A team of nurses and a physician has tailored a pre-existing platelet transfusion questionnaire for use in one large Midwest children's teaching hospital. The survey will be distributed electronically by January 2015 to physicians, surgeons, and intensivists who care for patients on a pediatric hematology/oncology unit. A potential challenge of this project is a low response rate to the survey. Survey data will be analyzed using descriptive statistics. A synthesis of current provider practices will be completed, with identification of potential inconsistencies among physicians, surgeons, and intensivists. The results of this project are pending. However, it is anticipated that results will be used to direct the development of evidenced-based guidelines focused on platelet transfusion practices.

Technology and Exercise in Older Adults

Emilie O'Connor
Mentors: Dr. Susan Dunn and Dr. Barbara Vincensi
Department of Nursing

Technology is expanding and becoming connected to many aspects of everyday life. Research is needed that investigates the connection between technology and daily life, especially where these intersect with health and in healthcare. This research project is based on Imogene King's Interacting Systems Theory, as it focuses on health and outside interacting systems. The purpose of this research is to investigate relationships between frequency of exercise and perceived technology literacy in individuals over the age of 65 years. This will be investigated through a cross-sectional descriptive study in the form of a survey that will be administered via SurveyMonkey. The survey will be sent to a convenience sample of men and women who belong to an organization for retired professionals in Michigan. A sample size of 160 is expected. Data collected will be analyzed using descriptive and inferential statistics using SPSS 19.0 software. Results and conclusions are pending. Anticipated limitations are the homogeneity of the sample being mostly of Caucasian descent, primarily of the same education level, and being from the same geographic area, limiting generalizability. It is expected that findings will increase nursing knowledge relative to technology and exercise in older adults and be used as groundwork for a larger nursing study that will investigate technology and exercise as an intervention to decrease hopelessness in cardiac patients.

The Relationship of External Devices and the Development of Pressure Ulcers in a Pediatric Population

Ashley Ritsema
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Efforts are being made to reduce the prevalence of the development of pressure ulcers in pediatric hospitals using pressure ulcer risk assessment tools including the Braden Scale, Braden Q, and Pediatric Pressure Ulcer Prediction & Evaluation Tool (PPUPET). Many factors lead to skin breakdown and pressure ulcer development. The purpose of this study is to determine the frequency of pressure ulcers related to the presence of external devices. The conceptual framework is based on Betty Neuman's Systems Model Nursing Theory, which looks at different variables in the internal, external and created environments that place patients at an increased risk for a certain condition. Information was gathered from 70 patients both male and female during a skin audit day at a teaching children's hospital in West Michigan. Pediatric patients on all inpatient units were assessed excluding the NICU, patients who refused the skin audit and those off the unit. Analysis of the data was run on SPSS using descriptive statistics to determine correlations and percentages. Chi-square tests were performed to determine relationships in the data. Results show no significant findings comparing the number of devices and presence of pressure ulcers (Pearson's r = -.159, p = .189). There was a significant positive correlation found between the number of devices and the PPUPET score given to that patient (Pearson's r = .697, p = .000). Limitations include data from one West Michigan children's hospital. This study will aid in the awareness of hospital-acquired pressure ulcers in the pediatric population and lead to implementation of tools that will work to identify early pressure ulcers caused by external devices.

Effect of Pet Therapy on Patients' Anxiety in the Pediatric Emergency Department

Jacqueline Roodbeen
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Pet therapy is a healthcare intervention in which an animal is an integral part of the treatment process. Despite the numerous studies documenting the benefits of pet therapy, there is limited research examining the effects of pet therapy in the pediatric population and the pediatric emergency department (PED). According to Florence Nightingale's Environmental Nursing Theory, a patient's healthcare experience and recovery can be positively impacted by manipulation of a stressful environment. A pet therapy intervention may therefore decrease the stressful environment of a PED. The purpose of this pre- and post-test quasi-experimental study is to describe the impact of pet therapy (dogs) in a PED. Research questions that will be addressed include: 1) Is there a reduction in pediatric patients' anxiety ratings after a pet therapy intervention, as perceived by the patients and by their parents/caregivers and 2) Is there a difference in pre- and post-anxiety ratings in patients who receive pet therapy when compared with patients who do not receive pet therapy? The anxiety level of pediatric patients, ages 5-18 years, will be examined before and after pet therapy visits (using both patient and caregiver responses) using an anxiety scale developed for the study. Data will be collected from a large children's hospital in Michigan with an anticipated sample size of 72 patients (36 receiving pet therapy and 36 who are not). The student researcher will collect data during January 2015 with analysis, interpretation, and conclusions by February 2015. After data collection, independent and paired t-tests will be used to analyze data using SPSS statistical software. Results and conclusions are pending. Anticipated limitations include lack of randomization, a self-report anxiety instrument, use of an anxiety scale with unknown reliability and validity, and potential subject bias due to the short time period between the pre- and post-data collections. Potential implications for nursing include increased understanding of pet therapy as an effective

intervention to reduce anxiety in children in the PED, which could improve their overall health during their hospital stay. Future research is needed with larger sample sizes in a variety of PEDs to further explore pet therapy as an effective intervention.

A Consistent Approach to Complex Patients with Secondary Psychiatric Diagnoses: The Orange Chart Project

Marvin Solberg
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This research is supported by Spectrum Health.

In a large Midwest hospital's complex medical inpatient unit, patients with secondary psychiatric diagnoses often exhibit intrusive behaviors, disrupting the unit and creating barriers to discharge. Because of such behaviors, the quality of care they receive may not be at its full potential. Little research exists regarding effective interventions for these patients that help reduce their negative behaviors or its detrimental effects on themselves, nursing staff, and other interdisciplinary team members. A protocol for this inpatient unit, titled the "Orange Chart" project, was introduced in November 2013 to improve consistent, team-based management of these patients. The purpose of this retrospective medical record review study is to identify if pilot use of the Orange Chart protocol was associated with an increase in psychiatric consults and a reduction in security consults, hospital length of stay, number of 30-day emergency department visits, and hospital readmissions for patients with secondary psychiatric diagnoses compared to pre-pilot use. Betty Neuman's Health Care Systems Model provides a theoretical framework for this study because patients are seen as open systems, reacting to stimuli, dictating their outcomes. The expected sample size is 30 patients from the single hospital inpatient unit of this Midwest hospital. Results and conclusions of this study are pending. Expected statistical analysis include independent t-tests using SPSS, with a value, $p < 0.05$ for all tests. Expected limitations include a small sample size and limited generalizability. Possible future implications include implementation of a consistent approach to behavioral management in this patient population throughout hospital systems.

A Quality Improvement Project to Reduce Clinical Alarm Fatigue in an Emergency Department

Claire Stinson
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The presence of alarms in an emergency department (ED) can be both chaotic for patients and result in desensitization of the nurses' awareness to alarms. The objective of this quality improvement project was to describe the number and type of SpaceLab alarms in a midwestern community hospital ED and disseminate these results to the nurses, with the goal of decreasing unnecessary alarms. The conceptual framework used was Jean Piaget's Theory of Constructivism, which explains learning as a process of integrating knowledge and experience to construct new ideas or concepts. Supporting literature was used to identify specific ways to reduce alarms, such as widening patient parameters and suspending monitoring when the patient is disconnected from the monitor. Pre-intervention data was collected by 2 student nurses on 4 occasions over a 2-week period (8 hours total) with a total of 654 alarms recorded from SpaceLab monitors. After collecting initial data, an intervention, focused on nurse education, was developed to reduce the number of SpaceLab alarms. Student nurses developed an 8-page education booklet to use at a 10-minute training session, including a presentation of the problem, instruction on widening limits and suspending alarms, and an interactive case study. The effectiveness of the intervention was evaluated by comparing the pre-intervention and post-intervention data. Two types of alarms were compared, with a 56 percent reduction of "sensor off" alarms (514

to 227) and a 68 percent reduction of "outside limit" alarms (140-45). The frequency of total SpaceLab alarms was reduced by 58 percent (654 to 272 total alarms), thus the nurse training session was effective. Limitations include data collected at one hospital with limited generalizability, potential for human error in data collection, and potential participant bias related to nurses' awareness of project goals. Emergency departments may consider providing nurse education to decrease unnecessary alarms. Future quality improvement projects should include interventions to increase nurse awareness, in addition to considering education for ED techs and radiology techs to further reduce alarms.

Nursing Presence: A Concept Analysis

Molly Tiesenga
Mentors: Professor Donna Garrett and Dr. Susan Dunn
Department of Nursing

Nursing presence has been a concept that has been difficult to define. It is a concept that dates back to Florence Nightingale; however, it has recently become a concept of interest in current nursing research and theory. Thus, the purpose of this analysis is to define and enhance the understanding of the concept of nursing presence in the acute care setting. A concept analysis based on Walker and Avant's concept analysis strategy was used as an organizing framework. A review of literature was completed using Cumulative Index to Nursing and Allied Health Literature or CINHAL, PsychInfo, and PubMed using the keywords: presence of nursing, caring presence, healing presence, and the art of nursing with the limits of adult only, published in English and articles from 1999 to present. After extensive analysis twelve articles were included as data. Each article was reviewed for defining characteristics, antecedents and consequences of nursing presence. Key characteristics identified were connectedness, sharing of human experiences, holistic view, and emotional and physical comfort. Results show that continued study of nursing presence is essential for finding further benefits for acute care patients. Further exploration of the differing attributes between caring, nursing presence, and the art of nursing are also needed. Limitations to this analysis include the limited number of databases used, including articles published in English only, and the limited amount of recent literature available.

The Relationship Between Elimination of the Newborn Bath with Skin-to-Skin Contact and Hypoglycemia

Kelsey Vander Laan
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Newborn care immediately after birth includes numerous activities including taking weight and measurements, administration of medications, bathing and swaddling. Baby Friendly is a nationwide hospital initiative that provides ten steps for hospitals to improve breastfeeding between mother and newborn. These ten steps were the basis used in elimination of the newborn bath at one Midwestern hospital. Evidence has shown the benefits of skin to skin contact immediately after birth on breastfeeding. This quality improvement study compared outcomes of newborn bath versus newborn bath elimination and the incidence of hypoglycemia. The study took place at a large Midwestern Magnet-designated hospital. Chart-reviews were completed and data entered into an Excel spreadsheet by the nursing student for 50 babies born in April 2014 and 50 in July 2014. Information on baths, breastfeeding, skin-to-skin contact, temperature, and glucose levels were gathered. Data analysis was completed using SPSS statistical software. Results showed no evidence that elimination of the newborn bath is related to improved patient outcomes. The retrospective aspect of this study provides a limitation because there were missing data and inconsistencies in charting. This study also only took place in one hospital with a small sample size, limiting the generalizability of the results. This study

provided evidence-based information for nursing care on whether there are benefits, besides increased bonding, to eliminating the newborn bath. Future research is needed with larger samples in a variety of hospitals with diverse populations.

The Maternal Infant Health Survey: Quality Analysis of Nursing Practice as it Relates to the Baby-friendly Hospital Initiative

Megan Walls
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Healthy People 2020 has stated that it is essential to increase the rate of newborns that exclusively breastfeed, and to decrease the intake of supplemental formula. The World Health Organization (WHO) has recognized the Baby Friendly Initiative as best evidence-based maternal infant practice through the completion of ten steps, follow-up, and accreditation. The purpose of this quality improvement study is to evaluate maternal infant practices relating to the Baby Friendly ten steps through a nursing staff survey. This research was based on Lewin's Change Theory of unfreezing, changing, and refreezing nursing practice. A Likert-scored survey was created and used to determine the current state of maternal infant practices. The survey was administered to 20 staff members on a labor and delivery unit from a small community hospital in Southwest Michigan. An arithmetic mean was used to analyze the results and determined if the ten steps were met (80% or greater), partially met (70%-80%), or not met (70% or less). These percentages were based on the Baby Friendly Initiative, which requires 80% compliance for each step of the ten steps. After analyzing these steps, one step was met, two steps were partially met, 6 steps were not met, and one step is pending. This study encountered generalizability and sample size limitations. The results of this study will facilitate current evidence-based practice in regards to maternal infant nursing interventions and will be a foundation for nursing education as it relates to obtaining optimal lactating mother and newborn outcomes.

Primer Design for Detecting Single Nucleotide Polymorphisms within the *Oxytocin Receptor Gene (OXTR)* among Persons with Alzheimer Disease

Katelyn Webster, Jamie Johnson, Michelle Kerr, and Jessica Hulteen
Mentor: Dr. Emilie Dykstra Goris
Department of Nursing

Apathy, defined as a disorder of motivation with deficits in behavioral, emotional, and cognitive domains, is a prevalent behavioral symptom among persons with Alzheimer Disease (AD). Various complications have been associated with apathy, such as physical deconditioning, uncooperativeness with care, and social isolation. Little is known about the characteristics of persons with AD, including biological factors, that contribute to the presence and/or severity of apathy. Variations in the *Oxytocin Receptor Gene (OXTR)* are hypothesized to be candidate modifiers of apathy severity in persons with AD. *OXTR* is approximately 19,000 bp in length and is located on chromosome 3. A DNA variant within *OXTR* (rs53576) significantly predicted 19.4% of the variance in apathy severity as measured by the Apathy subscale of the Neuropsychiatric Inventory (NPI-Apathy) ($F=3.379$, $p=.027$), while controlling for cognitive status and number of *Apolipoprotein E (APOE) e4* alleles in a previous study. The aims of this study were to design and successfully utilize primers and polymerase chain reaction (PCR) in order to amplify *OXTR* single nucleotide polymorphisms (SNPs) as a means to examine variations within *OXTR* that may be associated with apathy in persons with AD. Primer sets were designed to amplify seven SNPs (rs53576, rs237885, rs2254298, rs237887, rs2268493, rs2268498, and rs13316193) within *OXTR* and were tested using ten lab control human DNA samples. Gel electrophoresis results showed that bands migrated appropriate distances for the expected length of DNA fragments. This indicated successful DNA extraction, primer design, and amplification of all seven SNPs. Study

findings may contribute to a risk profile for identifying individuals with AD most at risk for apathy based on *OXTR* genotype, with a long-term goal to design targeted nursing interventions to benefit these individuals.

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Baby-Friendly Initiative: Elimination of Newborn Bath and Hypothermia

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Bathing has been a tradition integrated into the nursing care of an infant soon after birth to foster and promote cleanliness. However, previous studies have found a link between a decrease body temperature and evidence of hypothermia in infants who were bathed within the first few hours after birth. The purpose of this study focused on the effects of a delayed newborn bath on the condition of an infant; in particular, the project investigated if the presence of the baby bath within the first 12 hours of life significantly lowered the newborns' body temperatures enough to cause the symptoms of hypothermia. Betty Neuman's Systems Theory examines the interaction between a patient as a system and their surrounding stressors. Newborn baths can be a stressor by interrupting the evidence-based practice of maximizing skin-to-skin contact and affecting the newborns' vital signs, a part of their system. The project was completed with the obstetrical services of a large teaching hospital in Michigan. The hospital recently implemented a policy change eliminating baby baths in nursing care within the first 12 hours of life. Randomly selected charts of infants born one month before and after the change were retrospectively reviewed. The sampled population included 200 newborns admitted to the mother-baby care units at the hospital and born at a gestational age greater than or equal to 34 weeks, 100 newborns before and 100 after the policy change. The results and conclusion of the study are not yet known. Limitations of this project include that the study was completed at one hospital and was limited in sample size. The results and conclusions of the study can add to the nursing knowledge-base and provide a foundation of evidence-based practice for the care of newborns within the first 12 hours of life, opposed to the practicing tradition of newborn baths.

Meghanne Tighe (background), Boone Marois (foreground), both from Chemistry, presenting at the Celebration, 2015.

Janelle Kirsch, Chemistry, presenting at the Celebration, 2015.

PHYSICS

Two Dimensional Intermodulation Distortion Scanning of Superconducting Filter Resonators

Michael Bischak
Mentor: Dr. Steven Remillard
Department of Physics

This research was funded by the National Science Foundation under grant number DMR-1206149.

Superconductor nonlinearity, manifest through non-Ohmic conductivity, is not fully understood. In the past global methods, or a weighted average of an entire sample, have been used. But in order to fully understand where the nonlinearity comes from, one must use local methods or measurements that look at a specific point in the sample. Ohm's law for the sample becomes V=IR(I) because the resistance of the sample is dependent on the current. One local method consists of raster scanning samples with a magnetic loop probe. A problem encountered in doing this was that the probe resolution was too inadequate to image details across the width of a transmission line. This limitation was addressed in this work by reducing the size of the dipole loop on the magnetic loop probe. Using the electromagnetic field solver Sonnet, two dimensional current simulations of superconducting microwave filters composed of $Tl_2Ba_2CaCu_2O_8/LaAlO_3$ or of $YBa_2Cu_3O_7/LaAlO_3$ reveal microwave current which is bunched up at the corners and sides of the sample. Two dimensional images of third order intermodulation distortion made with the magnetic probe at the same corners and edges reveal elevated distortion in the same places. Using the magnetic probe, third order intermodulation was seen to come from the same corners and edges where the current is bunched.

Implementing a Coordinate Transformation for Scintillating Arrays

Jaclyn Brett and Braden Marks
Mentor: Dr. Paul DeYoung
Department of Physics

In the MoNA experiments at the National Superconducting Cyclotron Laboratory, three arrays of scintillators detect neutrons that decay from the nuclei produced in various reactions. Each array consists of stacked plastic bars, 64 to 144 in number. The interaction point of each neutron in an array is recorded with information about the specific bar and the location of the interaction within a single bar. However, this information is in the coordinate frame of the array. To obtain meaningful information about the momentum vector of the neutron, the positions where each particle interactions must be found within the coordinate frame of the laboratory. The original algorithm was only correct in cases where the arrays were horizontal, relative to the floor of the vault. A process was established for implementing coordinate transformation matrices to do these calculations for each array.

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Utilizing Scanning Electron Microscopy to Characterize SCM Tip Degradation and Microsphere Deposition

Daniel Clark
Mentors: Dr. Jennifer Hampton and Dr. Joshua Veazey
Department of Physics

Scanning Electron Microscopy (SEM) is a method by which the morphology of a sample can be determined. Energy Dispersive X-ray Spectroscopy (EDS) can determine the elemental composition of the sample. This project examined two microsystems using these techniques. The first microsystem examined the quality of the coating on Atomic Force Microscopy (AFM) tips. In contact AFM, a tip is physically dragged across the surface to determine the topography of the sample. The SCM model tips have a conductive coating, which can be damaged due to the dragging required to make the measurement. In the second microsystem, the SEM was used to examine the results of depositing polystyrene microspheres on gold substrates to determine what parameters lead to a close-packed monolayer.

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Analysis of Various Metalloprotein Stoichiometry's with Simultaneous PIXE and NRA

Zachary Diener
Mentor: Dr. Paul DeYoung
Department of Physics

Approximately one-third of all proteins contain metal cofactors or bind to various metals. Determining the absolute number of metals contained in these proteins has proven to be difficult. We hope to accurately characterize a protein's stoichiometry with two common ion beam analysis methods along with a standard preparation technique. A combination of Particle Induced X-ray Emission spectroscopy (PIXE) and Nuclear Reaction Analysis (NRA) is being developed to determine the areal density of a thin protein target along with the target's concentration of heavy elements. The results of this analytical method yield a stoichiometric ratio, along with the absolute numbers of the metal ions contained in a certain metalloprotein. Current work focuses refining the present method of protein preparation to yield the most consistent results while reducing uncertainty in the metallic ratios and absolute values.

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Capacitance and Hydrogen Evolution Reaction Characterization of Electrodeposited Nickel Alloy Thin Films

Matthew Gira
Mentor: Dr. Jennifer Hampton
Departments of Physics and Chemistry

With the global energy demand growing, there is greater need for production of energy. One of the ways of producing this energy is creation of hydrogen gas to store energy; however, this technique is not yet economically favorable compared to many other energy sources. One reason for this is the current use of platinum in hydrogen production. As a result, we are exploring other less costly metals for use as hydrogen producing catalysts. With the technique of electrodeposition, different nickel alloy thin films were created to characterize their structure, composition, and hydrogen production capabilities. Characterization was completed using atomic force microscopy (AFM) to measure roughness, scanning electron microscopy (SEM) with energy dispersive X-ray spectroscopy (EDS) to measure composition, and cyclic voltammetry to measure electrochemical capacitance. Linear sweep voltammetry was used to perform the hydrogen evolution reaction (HER), a reaction that produces hydrogen gas as a product. The use of these characterization techniques and HER measurements could help further understanding of the production of hydrogen and help fuel cells become more economically favorable using these earth-abundant metals.

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Compton Scattering Cross Sections in Strong Magnetic Fields: Advances for Neutron Star Applications

Jesse Ickes, Matthew Eiles, Matthew Baring, and Zorawar Wadiasingh
Mentor: Dr. Peter Gonthier
Department of Physics

Various telescopes including RXTE, INTEGRAL, Suzaku, and Fermi have detected steady non-thermal X-ray emission in the 10 - 200 keV band from strongly magnetic neutron stars known as magnetars. Magnetic inverse Compton scattering is believed to be a leading candidate for the production of this intense X-ray radiation. Generated by electrons possessing ultra-relativistic energies, this leads to attractive simplifications of the magnetic Compton cross section. We have recently addressed such a case by developing compact analytic expressions using correct spin-dependent widths acquired through the implementation of Sokolov & Ternov (ST) basis states, focusing specifically on ground state-to-ground state scattering. Such scattering in magnetar magnetospheres can cool electrons down to mildly-relativistic energies. Moreover, soft gamma-ray flaring in magnetars may well involve strong

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Comptonization in expanding clouds of mildly-relativistic pairs. These situations necessitate the development of more general magnetic scattering cross sections, where the incoming photons acquire substantial incident angles relative to the field in the rest frame of the electron, and the intermediate state can be excited to arbitrary Landau levels. The cross sections treat the plethora of harmonic resonances associated with various cyclotron transitions between Landau states. Polarization and spin dependence of the cross section for the four scattering modes is compared with the non-relativistic Thompson cross section with classical widths. The work here is purely analytical and is done to give compact analytical expressions for the Compton cross sections. Results will find application to various neutron star problems, including computation of Eddington luminosities and polarization mode-switching rates in transient magnetar fireballs.

Ferroelectric and Conductance Characterization of $SrTiO_3$ Thin Films Grown on Silicon

Andrew Johnson
Mentor: Dr. Joshua Veazey
Department of Physics

This work was generously supported by the Hope College Department of Physics Frissel Research Fund and the National Science Foundation under NSF-MRI Grant No. CHE-1126462. Portions of this work were conducted in the CMP group facilities at Michigan State University.

Thin-film ferroelectric/semiconductor heterostructures are regarded as potential platforms for high-density data storage. In certain structures, the local ferroelectric polarization state of the film has been shown to modulate conductivity with nanoscale precision [Maksymovych *et al.*, *Science* 324, 1421-5 (2009), Gajek, *et al.*, *Nature* 6, 296-297 (2007)]. Thus, information could in principle be encoded into the local polarization states of the thin film, creating nanoscale bits. $SrTiO_3$ (STO) thin films exhibit epitaxial strain-induced ferroelectricity when deposited directly onto the surface of n-type Si(001) [Warusawithana, *et al.*, *Science* 324, 367-369 (2009)]. In the work presented here, local probes were used to investigate the nanoscale ferroelectric and conductive properties of STO thin films (thicknesses ranging t = 2-10 nm) deposited on p-type Si(001) via molecular beam epitaxy, with a SrO interfacial layer. We observe classic signatures of ferroelectricity for samples having STO thicknesses of t < 5 nm. We patterned ferroelectric domains lithographically by applying voltages via a conductive-atomic force microscopy (c-AFM) tip. Domains were subsequently imaged with piezoresponse force microscopy (PFM), which indicated the ability to pole ferroelectric features with length scales of order 100 nm. Ferroelectric hysteresis loops revealed stable switching characteristics, with coercive voltages $V_c \approx$1-2 V. In addition, preliminary evidence suggests a correlation between polarization direction and conductivity (determined via current-voltage, *I-V* curves) through the sample. Conclusive evidence of such ferroelectric-modulated conductivity, however, would require simultaneous measurement of conductivity and ferroelectric switching. Current work is focusing on this prospect.

Population of ^{13}Be in Nucleon Exchange Reactions

Braden Marks
Mentor: Dr. Paul DeYoung
Department of Physics

This material is based upon work supported by the National Science

The traditional way of creating neutron-unbound nuclei involves the removal of one or more nucleons from a fast beam of ions. This method often results in a background that makes it difficult to identify the particle of interest; it also requires starting with beams that are heavier than the particle of interest. These beams are unstable, difficult to make, and have low intensities. In an effort to avoid these obstacles, the present work was done with a more unorthodox entrance channel called a nucleon exchange reaction. A beam of ^{13}B ions was produced at the National Superconducting Cyclotron Laboratory (NSCL) at Michigan State University (MSU), when this ^{13}B beam hit the 47 mg/cm^2 ^{9}Be target many reactions occurred, including a nucleon exchange reaction that produced ^{13}Be. The ^{13}Be nuclei decayed in approximately 10^{-21}seconds to ^{12}Be +

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n. The neutrons were detected by either the Modular Neutron Array (MoNA) or Large multi-Institution Scintillator Array (LISA), and the ^{12}Be fragment nuclei's paths were directed by a 4T superconducting sweeper magnet through an array of charged particle detectors. The four-momentum vectors (for the fragment nucleus and the neutron) were calculated to determine the decay energy of ^{13}Be, which is being compared with previous results. The cross-section for the nucleon exchange process is being determined.

Quantitative Characterization of Methanol Oxidation Catalysis on Dealloyed NiCu Films

Matthew Milliken
Mentor: Dr. Jennifer Hampton
Department of Physics

The topic of catalytic nanoporous materials has seen a surge of interest in the past decade. With Scanning Electron Microscopy (SEM) and Energy Dispersive X-ray Spectroscopy (EDS), the surface area, topography, and composition of these nanostructures can be characterized. The accessibility of these instruments has generated interest involving the interactive effects of surface topography and catalytic activity of binary alloys. The research conducted involved electrodepositing, dealloying, and characterizing various nickel-copper binary alloys on a Au substrate for methanol oxidation applications. By dealloying copper out of a NiCu alloy using Controlled Potential Electrolysis (CPE), a high-surface area nanoporous material was fabricated. The composition and capacitance of the NiCu alloys (before and after the dealloying step) were characterized via SEM/EDS, and Cyclic Voltammetry (CV) respectively. Utilizing Chronoamperometry (CA), the oxidation of methanol was analyzed before and after dealloying to determine whether porosity enhanced the catalytic efficiency.

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Electrodeposition and Dealloying of Nickel-Cobalt and Nickel-Cobalt-Copper Thin Films

Benjamin Peecher
Mentor: Dr. Jennifer Hampton
Department of Physics

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This project focuses on characterizing nickel-cobalt and nickel-cobalt-copper electrodeposited thin films. These films can be engineered to have high surface areas, giving them fuel cell and capacitance-related applications. Using a three-electrode electrochemical cell, metal alloys are deposited from solution onto a gold substrate. These films are then studied in a scanning electron microscope (SEM) with an energy dispersive x-ray spectroscopy (EDS) attachment to determine their structures and compositions. It was found that when nickel and cobalt are deposited together, there is consistently a higher ratio of cobalt in the film than in the solution. When nickel, cobalt, and copper are deposited together, the ratios in the film are generally closer to those in the solution, but there is more nickel in the film than in the solution. The nickel-cobalt and nickel-cobalt-copper films are then electrochemically dealloyed. To dealloy the films, a steadily increasing potential is placed between the working and counter electrodes, re-oxidizing the metals and pulling them off of the substrate. Different metals re-oxidize at different potentials, so depending on when one stops the potential, it is possible to pull out certain metals, leaving others behind. When dealloying the nickel-cobalt films, nickel and cobalt strip out of the film in nearly equal amounts, despite cobalt reacting at a lower potential. When dealloying nickel-cobalt-copper, nickel and cobalt are kinetically stabilized, and the copper pulls out, leaving a porous nickel-cobalt film behind. Preliminary results also suggest that dealloying the nickel-cobalt-copper films increases their capacitances.

PHYSICS

Differential PIXE Analysis of Multi-layer Auto Paint

Christina Sarosiek
Mentors: Dr. Paul DeYoung and Dr. Graham Peaslee
Departments of Physics and Chemistry

This material is based upon work supported by the Howard Hughes Medical Institute Undergraduate Science Education Program under HHMI grant No. 52007545 and the National Science Foundation under grant No. PHY-1306074.

Differential Particle Induced X-ray Emission (DPIXE) has been successful as a technique to analyze carefully-prepared multi-layer auto paint samples in a non-destructive manner. However, the analysis of weathered samples ripped from a car in a salvage yard is more difficult. Particle Induced X-ray Emission (PIXE) involves particle beams produced by a particle accelerator to analyze the concentration of elements present in one or more layers. As the beam penetrates into the sample, characteristic x rays of various energies are emitted which correspond to different elements in the sample. DPIXE involves varying the beam energy so the beam penetrates to different depths within the sample, emitting x rays from only the layers through which the beam has passed. Quantitative analysis begins with taking measurements of the thickness of each layer. A Scanning Electron Microscope (SEM) allows us to view a cross-section of paint and measure the thickness of each layer. A careful combination of the SEM data and DPIXE data is required to obtain accurate concentrations of elements in a sophisticated peak fitting program (GeoPIXE) with calculations of energy loss as the beam penetrates to different depths and reabsorption of x rays as they travel out of the sample towards the detector. We plan to continue to refine the technique and recreate the success of the carefully prepared sample with our weathered samples.

John Boss with Olivia Schwartzfisher, Engineering

Jessica Scott, Chemistry

Julia Slopsema and Lane Heyboer, Engineering

Michael Barrows and Nick Gibson, Biology

Effectiveness of Online Altruistic Viral Videos on Altruistic Attitudes and Behaviors

Jonathon Anderson and James Clark
Mentor: Professor Rebecca Johnson
Department of Communication

This research was supported by Frost Research Center at Hope College.

Photo of Jon and Jamie used in the recruitment email.

With the ubiquitous nature of the internet, people are exposed to and influenced by a wide range of media and messages. In June of 2014, Facebook revealed manipulating user's news feeds with either negative or positive messages, thus impacting the kind of subsequent posts of the users. Users mirrored the emotional valence in their newsfeeds with their own posts (Kramer, Guillory, & Hancock, 2014). Similarly, in fall 2014 the ALS Ice Bucket Challenge went viral via social media raising millions for ALS funding. Will people be moved enough by a viral video to perform altruistic acts without a personal challenge from a friend?
An information processing model combined with a media effects theory predict the following hypotheses. H1: Online exposure to altruistic acts increases altruistic attitudes. H2: Online exposure to altruistic acts increases altruistic behaviors. Participants were randomly assigned to one of two conditions: a treatment group, exposed to an altruistic video with a general call to action of spreading kindness, and a control group, exposed to a control video of a puppy. Both groups were tested on altruistic attitudes (Nickell, 1998) and likelihood of future altruistic behavior (Rushton, 1981). Within two weeks of original exposure, a second round of data collection assessed altruistic attitudes, likelihood of future altruistic behavior, and altruistic behavior performed since initial participation. Results support that exposure to altruistic videos increases altruistic attitudes, likelihood of altruistic behavior, and actual acts of altruism. Results also reveal attitudes and likelihood of behavior increase over time. The uses of viral altruistic videos that contain a general call to action without a personal challenge are effective in increasing altruistic attitudes and behaviors.

Photographic Representations of Happiness in USA and Japan

Elizabeth Reynolds, Nicole Demikis-Bayron, and Erika Ryan
Mentors: Dr. Deirdre Johnston[1] and Dr. Rika Hanamitsu[2]
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Happiness is a universal emotion, but how people construct the meaning of happiness may be culturally determined. The study explores a cross-cultural comparison of the awareness, photographic representation of, and feelings associated with, experiences of everyday happiness. The research question examines whether there are differences in the construction of the meaning of happiness by American and Japanese college students. An ethnographic design was used to collect happy experiences through photographs. The sample of 200 was stratified by age range (student, young adult, middle-age, and elderly), culture and sex, with 60 college students as the sub-sample. Participants completed a pre-test employing Deiner's Flourishing Scale (2009). Packets including a disposable camera, a Photo Release Form, and Photo Response Cards were disseminated, instructing participants to take 5 photographs during moments of happiness, over a 24-hour period. The post-test included the Flourishing Scale and questions regarding how comprehensive and typical their photos were in representing their happiness. Researchers qualitatively analyzed 300 photographs and narratives for cultural themes and dimensions by which happiness experiences vary. Coding categories were then developed and inter-

This material is based upon work supported internally by the Frost Research Center at Hope College.

rater reliability was assessed. Participant narratives were coded for emotional complexity according to the Levels of Emotional Awareness Scale (Lane, Quinlan, Schwartz, Walker & Zeinlin, 1990). An ANOVA was conducted to compare pre- and post-test flourishing scales to find whether reflecting on happiness significantly impacted respondents' reported happiness. Researchers found cultural differences in Japanese and American students' reporting of source of happiness, meaning of happiness, arousal level of happiness, awareness and cognitive processing of happy experiences, what kinds of satisfied needs engender happiness, and the impact of reflecting on happiness on one's overall level of flourishing.

Elizabeth Reynolds, Nicole Demikis-Bayron and Erika Ryan with Dr. Deirdre Johnston and Dr. Rika Hanamitsu.

The Link Between "Likes" and Self-Worth: How Women Use Selfies on Instagram for Self-Presentation and the Effects of Social Comparison

Justine Poe
Mentor: Dr. Mi Rosie Jahng
Department of Communication

In the past decade, selfies have quickly become a part of North American popular culture. On any given day, Instagram users collectively post upwards of thirty-five million photos with a selfie-related hashtag. Self-preservation theory and uses and gratification theory are utilized to explain this social media phenomenon. Instagram is the main platform for this study because its environment cultivates the largest number of selfies from its users. This study seeks to explain potential effects on self-esteem of the participants of the selfie phenomenon by utilizing the social comparison theory. The main research question addresses whether women are more likely to post selfies to Instagram when their self-esteem is high or low, and if a relationship exists between the number of likes a selfie receives on Instagram and the self-esteem of the subject. The implications of this study could yield significant insight to predicting media behavior in college women and understanding the complexity of the effects such behavior may cause on self-esteem.

Do Attitudes about Love Say Anything about How Accepting of Lies We Are?

Sarah Schuiling and Odille Parker
Mentor: Dr. Jayson Dibble
Department of Communication

Research indicates that the number of people who use online dating has increased rapidly over the last decade. With this form of technology for building relationships come new potential dangers, including deception. Deception research suggests people lie for a reason. In the case of online dating, the necessity of people to control how they present themselves to others might lead people to lie in order to manage other people's impressions and thereby attract more dates. Research shows that men and women who lie while using online dating indeed deceive about distinct characteristics. One perspective that may help explain people's use and acceptability of deception in online dating is the love attitudes framework (Lee, 1988). According to this framework, people's attitudes toward love can be described according to one or some blend of six different love style categories—Eros, Ludus, Pragma, Storge, Mania, and Agape. This study conducted by survey (N=76) explored the relationship between lie

acceptability and the six love styles with an emphasis on Ludus and Mania. It was hypothesized that due to defining characteristics of the Ludus (game-playing) and Mania (insecure, clingy) love styles, someone who is high on Ludus would be more accepting of lies told online, and those who were highly manic would be less accepting toward deception online. That is, lie acceptability should correlate positively with Ludus and negatively with Mania. As predicted, results indicated a moderately strong, negative correlation between Mania and lie acceptability, and a moderately strong, positive correlation was found between Ludus and lie acceptability. The results for both love styles, however, were not found to be significant.

He Said, She Said: A Study of Gender, Framing, and Cultivation in the Ray Rice Domestic Violence Incident

Kasey Wierzbicki
Mentor: Dr. Mi Rosie Jahng
Department of Communication

In 2014, Ray Rice, a player in the National Football League, found himself at the center of a domestic violence incident. Rice attacked his then-fiancé in an elevator and a video of the incident leaked to the public. The purpose of this research is to examine how news portrayals of Ray Rice on this incident have affected viewers' support and acceptance of domestic violence based on cultivation and framing theory. Television consumption is a significant predictor of the levels of acceptance of rape violence (Kahlor & Eastin, 2011). Similarly, this study will examine the impact of domestic violence coverage on viewers' acceptance of domestic violence. It is hypothesized that heavy viewers of NFL-related television are more supportive of Rice compared to non-heavy viewers, females are likely to be less accepting of domestic violence in the Rice incident compared to males, and negatively-framed news coverage will create a negative evaluation of Rice and domestic violence compared to positively-framed news coverage. In a 2x2 between-subjects experiment (male vs. female and positive tone vs. negative tone), participants watched news reports with either male anchors or female anchors. The reports were either positively or negatively framed. Afterward, participants completed a questionnaire about their level of support for Rice, their level of acceptance of domestic violence, and their average amount of weekly NFL-related television consumption. Participants were undergraduate students at Hope College, enrolled in communication courses, and voluntarily completed the experiment for partial course credit or extra-credit. Based on the results, it can be suggested that reporters using victim-blaming and perpetrator-defending frames when covering domestic violence influence the audience to believe that domestic violence is not problematic. The results of this study can be used to challenge news media to report more neutrally to affect a reduction in domestic violence incidents.

Becoming Our Machines: Understanding and Responding to "Machine-Mindedness"

Karina Winkelman
Mentor: Dr. James Herrick
Department of Communication

Donald MacKay wrote in his 1974 book, *A Clockwork Image*, "In our age, when people look for explanations, the tendency more and more is to conceive of any and every situation that we are trying to understand by analogy with a machine." He called this condition, "machine-mindedness." What are the sources of this perspective and what concerns, if any, does it raise? This paper argues that the "machine-minded" perspective is more prevalent and more dangerous than one would expect. The history of "machine-mindedness" is traced back to Descartes into the Cybernetics era of the '40s and '50s to present day cognitive psychology and futurism. Though many perpetuate this perspective, this paper provides insight into the challenges associated with "machine-mindedness", particularly its impact on our view of what it means to be human.

ECONOMICS & BUSINESS

Perceived Religious Discrimination of the Affordable Care Act: A Millennial Generation Perspective

Chelsea Barfield
Mentor: Professor Sheri Geddes
Department of Economics and Business

The Patient Protection and Affordable Care Act of 2010 is changing the American healthcare system. Worldwide media attention has been given to the controversial question: should all people be entitled to basic health-care, including surveys from the Kaiser Family Foundation, Pew Research Center, and the Wall Street Journal. However, minimal research has focused on the perspectives of the millennial generation. The purpose of this project was to survey the beliefs of Hope College students regarding the Affordable Care Act, specifically focusing on potential religious discrimination. While our study was inconclusive regarding perceived religious discrimination, it revealed that students have limited knowledge of the Affordable Care Act, and their knowledge sources are diverse.

This material is based up work supported by the Frost Research Center at Hope College.

Preventing Obesity: The Impact of Parental Involvement on Children's Nutritional Health

Kaitlyn Chiazza
Mentor: Dr. Sarah Estelle
Department of Economics and Business

Child obesity rates have dramatically risen over the past years, tripling from 5% in the 1970s to 15% in the early 2000s (Anderson, Butcher and Schanzenbach). The concern about this so-called epidemic has not escaped academic study. Economists have been especially interested in identifying the causes of obesity. Once the causes of obesity are identified, policy makers and families can make plans to improve child health. Some economic studies find parental involvement to be a strong influence on children's obesity because the parent is able to mediate factors in the home environment that relate to food-related activities. This research utilizes variables that reflect parental involvement from the Early Childhood Longitudinal Survey—Kindergarten to determine the relationship between parental involvement and children's nutritional health, including junk food consumption and obesity. Using a fixed effects model, this study finds that some parent activities in the household have an impact on child junk food purchase and consumption, but there is limited impact found on child BMI.

Do the Highly Skilled Rich Pay Income Taxes? State Tax Incidence using Major League Baseball Data

Joshua Coulter
Mentor: Dr. Sarah Estelle
Department of Economics and Business

This research studies the responsiveness of the rich to state income taxes. Interstate migration is worrisome to policy makers because talent may move, in effect voting for lower income taxes with their feet. Furthermore, businesses may choose to locate elsewhere if they bear the burden of the tax or if they cannot attract skilled labor. To test whether employers or highly productive employees bear the burden of the state income tax and to what extent, I use Major League Baseball Data (MLB) from 1992-2012 of all free agent transactions. MLB data is useful in this analysis because it provides both performance and salary data, which is nearly impossible to observe in other highly skilled markets. I will use team and year fixed effects to find the effect of taxes on take home pay. This will help control for other factors in a free agent's decision-making processes such as team and city characteristics. Standard errors are too large to yield results on the effect of tax rate. This is likely due to other factors in salary negotiation.

Eyewear Against Poverty: What is the Effect of Visual aid on Income?

To assess the impact of visual aids (glasses) on household income, this research uses a fixed effects model to compare average consumption levels between regions treated and untreated by a donor company, Focus on Vision. Panel data from the Living Standards Measurement Survey over regions within Tanzania are suitable for a fixed effects design. However, it is likely that the combination of small samples within regions and the limited (relative to population)

Erik Groothuis
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donations from Focus on Vision are insufficient in size to capture the causal effects. This research provides solid theory, methodology, and modeling to reveal the causal effect of visual aid on income. Moving forward, the inconclusiveness of the results can be improved upon with an experimental approach and gathering more individual-level panel data.

How does a Clean Water Project Affect Health in Developing Countries?

Cody Herbruck
Mentor: Dr. Sarah Estelle
Department of Economics and Business

How does donating to a clean water initiative really impact the region that receives your donation? This research considers how clean water projects affect child survival in developing countries. One might expect clean water projects to improve overall health by ridding the water of diseases, some potentially fatal for humans. But clean water can also improve the health of livestock and crops leading to healthier food for consumption. However, to identify the causal impact of a clean water intervention, research must control for the fact that treatment is not assigned randomly. For example higher populations are more likely to receive a clean water project and are also likely to have better infrastructure and water that is more tolerable to begin with than areas of low population. For the purpose of this paper I use data from Ghana (treated) and Zambia (control) from the Integrated Public Use Microdata Series (IPUMS) database. A difference-in-differences technique has been used to look at individual child survival within two countries of similar attributes, with data from before and after the water projects occurred. This research shows that clean water projects have increased the child survival rate in Ghana by 4.8 percent.

It's Only a Matter of Time: How the Timing of Parental Marriage Affects a Child's Care Outside of the Home

Charlotte Korson
Mentor: Dr. Sarah Estelle
Department of Economics and Business

Studies have shown that when parents are married, their children benefit; however, less is known about the timing of marriage and its effects. Marriage is a decision parents make together thus it would appear there would be a spiral effect on their children. An important aspect in a child's life is time spent outside of the home. And if parental decisions affect their child, it would be expected that their decision to marry would be a factor on whether or not their child is placed in care outside of the household. This path has not been explored in economics thus driving the research question at hand looking at how the timing of marriage relative to the birth of the child affects the emphasis parents place on their child's care outside of the home. The research question is answered with the implementation of the Fragile Families and Child Well-Being Survey. "Fragile families" are those who grow up outside of the traditional home. And according to the survey, they are at higher risk of failure on several levels, including education. The study at hand will challenge this statement. Regression analysis is employed to uncover the consequences that stem from the timing of marriage. The timing of marriage does have an effect on whether or not the parents place their children in care outside of the home.

Class Act: The Effects of Increasing Immigration in Metropolitan Areas on High School Graduation

Benjamin Lewis

The number of foreign-born students in American schools has increased significantly over the past few decades. This project explores the effects of increasing immigration rates in major metropolitan areas on the graduation rates of those areas. Immigration in the United States has risen to 40 million people as of 2010 according to the Center for Immigration Studies - its highest mark in history. For those that have already immigrated to the United States to obtain work, their new goal is now to involve either themselves or their families in the education system, because the demand for highly skilled labor has increased.

Mentor: Dr. Sarah Estelle
Department of Economics and Business

Results from this study could show policy makers in what way education, especially public education, can be expanded or adapted if local governments want to. Overcrowding, peer influence and student performance are a few of the many issues associated with education and immigration, and are important questions concerning the future of the American education system. Utilizing data from the 1980, 1990 and 2000 census, this study employs a fixed-effects model to measure these effects and control for other mediating factors. This study observes both the total graduation results of metropolitan areas as well as the graduation results of immigrants, natives and other demographics, allowing us to compare them.

Does Walking the Beat Matter? The Impact of Local Police on Crime

Grant Ludema
Mentor: Dr. Sarah Estelle
Department of Economics and Business

What components work to reduce crime? This has been an important field of research within economics over the last half of a century. Since Becker (1974) established the foundational framework, this science of crime economics has been expanded on. If criminals behave rationally, responding to incentives and punishment just as any other person in society, then crime deterrence becomes a question of reducing the benefit of crime and/or increasing the cost. This research examines the impact that the local police force, defined as a police force dedicated to one locality (the city's sole police force not incorporated by a neighboring municipality or county), has on crime. By employing a series of Ordinary Least Squares analysis of Unified Crime Reports and census data taken from the local, state, and federal level, it is possible to determine if having a local police force has a significant correlation with crime. The extensions from this research provide insight into methods to deter crime, which is of great importance from a public policy perspective. Local police appear to be significant and deter crime. Future work should explore possible mechanisms relating to the differences that a local versus nonlocal police department may offer and how this works to shape the overall criminal behavior of a city.

Benefiting from a Free Lunch?: The Effects of the Community Eligibility Provision (CEP) on School Performance in Michigan

Brennan Mange
Mentor: Dr. Sarah Estelle
Department of Economics and Business

The Community Eligibility Provision (CEP), also referred to as the Community Eligibility Option (CEO), of the 2010 Healthy, Hunger-free Kids Act is a unique piece of federal public policy that expands the National School Lunch Program (NSLP). CEP eliminated the need for individual applications for subsidized lunches by providing funds for schools to feed all enrolled students breakfast and lunch if the school meets a 40% "identified student" requirement. Michigan, Kentucky, and Illinois were the first states to begin the phase-in of the program. This paper utilizes data from the Michigan Department of Education for the school years beginning in 2007-2013, which nicely frame 2011, the first year that CEP was an option for schools. This paper utilizes difference-in-difference analysis with school fixed effects to measure the effect of CEP participation on the school outcomes of attendance, standardized test scores, and expulsions. The results will indicate the degree to which an expansion from a means tested school meals program to a universal program impact school performance. The results indicate that CEP participation is correlated with a decrease in test scores, attendance rates, and expulsions. Further evaluation is needed to explain these results.

Does Financial Aid Affect Academic Performance? The Effects of Student Aid on GPA

Drew O'Brien
Mentor: Dr. Sarah Estelle
Department of Economics and Business

Increasing numbers of students are attending higher education institutions. From 2001 to 2011 enrollment in degree-granting institutions increased by 32 percent. Over the past seven years, the proportion of students receiving any amount of aid at these institutions has increased by 10 percentage points. As more individuals receive aid and pursue college degrees, it is important to recognize the potential financial aid has for effecting where students attend and how they perform when they get there. Using a dataset internally acquired through Hope College, this research focuses on the effect of financial aid on student academic performance as measured by GPA. Understanding the factors that contribute to greater academic performance can help both students and institutions. The empirical results of this research, though not causal, show a positive correlation between merit financial aid and collegiate GPA, though the magnitude of this relationship diminishes with the addition of controls for observable student ability. Needs-based aid appears to decrease GPA, although this correlation may be confounded by unobservable student characteristics, such as the student's financial resources and necessity of maintaining school year employment. The main control factors of race, gender, and past academic history prove to be the biggest indicators of collegiate academic performance and significantly affect student GPA.

Is it Worth the Wait? The Effect of a Woman's Sexual History on Divorce

Jennie Pollack
Mentor: Dr. Sarah Estelle
Department of Economics and Business

This research estimates the role that a woman's number of previous sexual partners has on the outcome of her first marriage. The social sciences have notable literature regarding this effect, and though economists have joined the conversation in regards to examining the impact of cohabitation, there are no economic studies on the impact of a woman's sexual history. Advanced econometric methods can separately identify the effects of religion, age, education, and cohabitation, as well as explore the causal impact of a woman's number of sexual partners. The Female Respondent File of the 2006-2010 National Survey of Family Growth provides data on the past intimate relationships of over 12,000 women. I examine this information along with other variables including religiosity and income to account for potentially confounding factors. This study uses age of menarche as an instrument for number of sexual partners. While an OLS model suggests a significant positive correlation between the number of premarital sexual partners on the likelihood of divorce, an instrumental variable strategy fails to identify analogous causation. In both models the number of premarital cohabitations is positively correlated with divorce. Ultimately, causality is unclear due to a lack of statistical significance in the instrumental variable.

EDUCATION

Exploring Alternative High Schools: Does Emotional Intelligence Matter?

Barbara Bollhoffer and Grace Horn
Mentor: Dr. Laura Pardo
Department of Education

This is an intervention study focusing on the social and behavioral objectives in high school settings. Our research centers on the development and implementation of an alternative high school. The foundational concept for the school will embody various traits of emotional intelligence: being immersed in the curriculum, the philosophy, the atmosphere, and the teacher/student relationship. Students who attend alternative high schools, their teachers, parents, and administrators comprise the participants in the study. Our research includes quantitative data (tracking suspensions, dropouts, re-entries, graduation rates), qualitative data (interviews, focus groups, surveys, observations, and case studies with students, parents, and teachers), and interventions in a social and behavioral context (e.g. emotional intelligence concepts, core democratic values, team building, goal setting, experiential learning, meditation, school to work transitions, and teachers as a mentor). An ideal alternative high school would accept students who have been unsuccessful in a traditional high school setting. These students will most likely have struggled socially, academically, and behaviorally in previous school experiences. The goals we have for the students attending this school include independence, receiving a diploma or GED, staying out of jail, attaining and retaining a job, and maintaining regular attendance at school. The goal of the study is to identify successful features of alternative high schools, and to consider how an innovative program might draw on both new and existing interventions that research has shown can produce beneficial impacts on students' educational outcomes. In addition to the quantitative and qualitative data sources, a comprehensive review of the literature will inform the design and implementation plan for alternative high schools. Topics reviewed include at-risk students, teachers as mentors, class sizes, successful alternative high schools, and emotional intelligence.

Teaching and Learning: The Impact of the Hope College Summer Enrichment Program on Hope Students and Child Attendees

Jessica Burtka
Mentor: Dr. Patricia Griffin
Department of Education

The present study collected anonymous data, using questionnaires, from Hope student teachers and the parents of children who attended the Summer Enrichment Program (SEP). The SEP provided a learning laboratory experience for four Hope students in the Early Childhood Education (ECE) program. Hope students planned, implemented and assessed developmentally appropriate activities and experiences to meet the needs of a diverse group of 3- and 4-year-old children, with the support of the Director of the ECE program. Recruitment for the SEP intentionally targeted children who attend local Head Start and Great Start to Readiness programs, in order to include a diverse group of children who typically would not have educational/enrichment opportunities during the summer months. The program was designed to benefit Hope student teachers through opportunities to apply what they learned during ECE coursework and to participate in a co-investigation with faculty. The program design also benefitted child attendees and their families through opportunities to interact with well-qualified educators, experience low student-teacher ratios and participate in a research-based, developmentally appropriate program. Hope student and parent questionnaire responses provided quantitative data using a Likert scale and qualitative data from responses to follow-up, open-ended questions about the perceived effects of the overall experience. Preliminary data analysis was focused by question and analyzed across all respondents to identify consistencies and differences. Responses from parents and Hope student teachers

were overwhelmingly positive. Responses from parent questionnaires included that children enjoyed the experience and benefitted from program activities and interactions with teachers. Responses from Hope student teacher questionnaires included that they benefitted from having the responsibility to plan and teach for an entire week, and they would like to have more opportunities to interact with families.

Reading Skills Have Improved! Results of an After School Tutoring Program

Allix Hutchison, and Melissa Lamberts
Mentors: Dr. Jane Finn and Dr. Vicki-Lynn Holmes
Departments of Education and Mathematics

Children's After School Achievement (CASA) is an after-school tutoring program that pairs Hope College volunteers with at-risk elementary learners from the Holland community. The purpose of this study was to track children's growth in reading skills after participating in the CASA program for an academic school year. Students were given the *Brigance Comprehensive Inventory of Basic Skills* (CIBS II) subtests of word recognition, oral reading, and reading comprehension. A paired sample t-test was conducted to determine whether these at risk children improved their reading skills. This study summarizes the findings of this research.

Vicki-Lynn Holmes, Melissa Lamberts, Jane Finn and Allix Hutchinson

College Students' Perceptions of a Tutoring Program

Audrey McKenzie and Kelly Leikert
Mentors: Dr. Jane Finn and Dr. Vicki-Lynn Holmes
Departments of Education and Mathematics

Children's After School Achievement (CASA) is a one-on-one after school tutoring program where at-risk elementary students from the Holland area are paired with a Hope college student. These college tutors come from a variety of majors and volunteer their time. The elementary students come to Hope College's campus twice a week for two-hour sessions to work on homework, reading, and life skills. For this study, the Hope College tutors were surveyed to uncover their perceptions about the elementary student's enjoyment of CASA, academic achievements, and benefits of the CASA program. This survey is part of a longitudinal study and the results and conclusions of the project are summarized in our research.

What Makes a Successful Teacher Candidate? Predictors in a Teacher Prep Program

Anne Neumann, Jessie Hermann, and Elizabeth Tally
Mentors: Professor Madeline Kukla, Dr. Jane Finn and Dr. Vicki-Lynn Holmes
Departments of Education and Mathematics

What makes a successful teacher? The state of Michigan defines passing the *Michigan Test of Teacher Certification* (MTTC) as the gateway to certification for teaching in our public, charter and private schools. To determine what factors affect teacher candidate success, we studied over 100 individuals who either successfully or unsuccessfully completed Hope College's teacher education program to see if there are any possible predictor variables for success. These valuables included gender, major, overall GPA, Education GPA, and ACT scores. We looked at what effect these factors played in teacher candidates overall success, as well as the factors associated with certified secondary and elementary majors. Descriptive statistics along with Chi Square tests were completed. Our research will discuss the results and conclusions of this project.

Jessie Hermann, Vicki-Lynn Holmes and Jane Finn

EDUCATION

Making a Difference: Getting Inside the Tutor's Mind Concerning the CASA Program

Jillian Sommerville and Rachel Lundstrom
Mentors: Dr. Jane Finn and Dr. Vicki-Lynn Holmes
Departments of Education and Mathematics

The purpose of this research was to determine how *Children's After School Achievement* (CASA) tutors perceived the effectiveness of this program. CASA tutors are undergraduates attending Hope College who are paired with elementary at-risk students to work on reading, math, other homework, and life skills. A 14-question survey was given to the 105 tutors asking about the effectiveness of the program along with their interactions with these elementary students. This portion of the research is using the second year of data results (continuing from a previous undergraduate project). Data analysis using a one-sample t-test revealed that CASA tutors believed their students benefited from required reading time, that this program was enjoyable for students and tutors, and students benefited both academically and non-academically. Comparison between the first year and second year will be noted.

Independent Skills Improve! Results of the *Transition Planning Inventory*

Chris VanKampen
Mentors: Dr.Vicki-Lynn Holmes and Dr. Jane Finn
Departments of Education and Mathematics

The purpose of this study was to determine whether the Friendship House roommates with disabilities believed that they have grown in their independent living skills. The Friendship House is a unique living situation where individuals with cognitive disabilities live side-by-side with university/college students. For this study, the residents with disabilities were surveyed using the assessment entitled the *Transition Planning Inventory* (TPI). The questions queried about these individuals' employment, further education/training, daily living, leisure activities, community participation, health, self-determination, communication, and inter-personal relationships. Results from the TPI show that these roommates with disabilities believed that they improved in the areas of community, self-determination and communication. Overall, the Friendship House has shown a positive effect on these residents with disabilities in terms of improving their transition skills.

Examining Educators' Attitudes of the Common Core State Standards for Mathematics

Jacob Verschueren
Mentors: Dr.Vicki-Lynn Holmes and Dr. Jane Finn
Departments of Education and Mathematics

In October 2013, the House and the Senate officially approved the initiative for statewide implementation of the Common Core State Standards (CCSS) in mathematics, and has been met with much hesitation and opposition from educators. To learn more about secondary mathematics teachers' views of the mathematics standards and their preparedness in putting them into practice, Michigan Council of Teachers of Mathematics in conjunction with Hope College surveyed 100 secondary math teachers after participating in a 3-day Common Core-related conference. Attendees reported on a range of topics, including how prepared they felt to teach different student demographics, their familiarity with different math subjects' standards, and what they felt would be helpful for improving their comfort with the CCSS in math classrooms. The results of Chi-squared comparisons between the pretests and the posttests suggest results that most teachers felt familiar with what was expected of them. These secondary teachers felt their curricular materials were not aligned with the CCSS, and more targeted preparation was necessary. The student populations causing most concern were ESL and special education students. Finally, educators reported that more planning time, more time to collaborate with colleagues, and access to more CCSS curricular materials would be helpful to prepare for classroom implementation. Information from this study can be used to create more effective professional development sessions in the future.

The Effect of Beta-Alanine Supplementation on Time to Exhaustion in Collegiate Middle Distance Runners.

Maggie Bailey, Andrew Borror, Jordan Hoogerhyde, Taylor Klos, and Sydney Papa
Mentors: Dr. Mark Northuis and Dr. Maureen Dunn
Department of Kinesiology

Beta-alanine is an amino acid that has been shown to increase muscle carnosine concentrations, resulting in an increased buffer capacity and reduced muscle fatigue. Prior research has suggested that beta-alanine may have ergogenic effects in exercise bouts lasting 1-5 minutes. However, there have been no studies on trained runners who compete in events lasting 1-5 minutes. Therefore, the purpose of this study was to examine the effect of beta-alanine supplementation on time to exhaustion in collegiate middle distance track athletes. Seventeen runners performed a treadmill pretest consisting of a VO2 max test followed by 90 seconds of rest and a time to exhaustion test. Participants were matched based on gender, time to exhaustion, running economy, max velocity and VO2 max. Participants were assigned to either a placebo group or a beta-alanine group. The experimental group took 4.5 grams of beta-alanine per day for four weeks. The placebo group ingested sucrose. The runners then participated in their standard training regimen, doing the same number of hard workouts per week and recording their total mileage. At the end of the supplementation period, the participants completed a treadmill posttest following the same protocol as the pretest. Differences in time to exhaustion were compared between the groups. It was hypothesized that beta-alanine supplementation would improve time to exhaustion performance more than the sucrose. Significant results would demonstrate the efficacy of beta-alanine supplementation in trained middle distance runners.

Comparing the Training Effects of Slow Flow to Power Yoga on Flexibility, Balance and Aerobic Capacity in College-Aged Females

Lauren Brown, Ashleigh Stewart, and Hannah Tweed
Mentor: Dr. Maureen Dunn
Department of Kinesiology

Yoga practice has become an increasingly popular form of exercise among various populations. However, a comprehensive comparison outlining the benefits from each of the many forms of yoga practice does not exist. This study was designed to determine whether participating in Vinyasa yoga (VIN, n=11) or Hatha yoga (HATHA, n=9) for 60 minutes, 2 times a week for 4.5 weeks would result in greater improvements in overall flexibility, balance, and aerobic fitness compared to a control group (n=6) that did not do any yoga training. It was hypothesized that participants in the VIN group would display a greater increase in aerobic capacity compared to the HATHA group and control group, and that those in the HATHA yoga group would improve more in flexibility and balance compared to the control group. Following 4.5 weeks of yoga training, significant improvements were seen in sit-and-reach score (HATHA pre: 40.9 +/- 2.1 cm, HATHA post: 42.6 +/- 1.7 cm, VIN pre: 39.1 +/- 1.9 cm, VIN post: 44.0 +/- 1.6 cm, p=0.003) and shoulder flexion (HATHA pre: 170. +/- 3.0 degrees, HATHA post: 178.1 +/- 1.7 degrees, VIN pre: 179.8 +/- 2.7 degrees, VIN post: 183.7 +/- 1.6 degrees, p=0.008). Improvements were also observed in time to hold single leg stance with eyes closed (HATHA pre: 18.9 +/- 5.5 seconds, post: 29.5 +/- 6.1 seconds, VIN pre: 35.5 +/- 5.0 seconds, VIN post: 41.4 +/- 5.5, p=0.058), but there was not enough statistical power to see significant differences between HATHA and VIN yoga groups or CON. Therefore, it may be suggested that participation in a yoga training program will result in increases in flexibility and balance, but neither Hatha nor power Vinyasa regimens will result in more significant gains than the other.

Performance Anxiety in Athletes

This is a rapid evidence assessment on the topic of anxiety in athletes, also known as performance anxiety. Anxiety is defined as a negative emotional reaction that results from experiencing a demanding situation and appraising it as a threat. The physiology behind anxiety is complex. The amygdala and bed nucleus of the stria

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Cody Brumm
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terminals, located in the frontal lobe, send signals to the locus ceruleus, located in the parietal lobe, and combined they are responsible for the emotions behind the fear response or the "fight or flight" response. The hypothalamus and pituitary gland cause the adrenal gland to produce cortisol and adrenaline, boosting the sympathetic nervous system. Anxiety plagues many athletes through cognitive thought and somatic bodily functions. Cognitive anxiety is disruptive in athletics because mental resources are being used inefficiently. Somatic arousal is necessary in athletics because it enhances reaction speed of decision making as well as physical reactions. Types of anxiety include state anxiety, which is caused by external sources, and trait anxiety caused by internal sources. Some athletes suffer from state anxiety, which can be deemed moment-to-moment or situational, or trait anxiety, which is innate and psychologically driven. An athlete's ego can positively or negatively affect the outcome or degree of their anxiety. Methods to alleviate and accommodate for anxiety are also reviewed.

Validity of the Shuttle MVP™ on Improving Vertical Jump Compared to Depth Jump Training in Experienced College-aged Jumpers

Kristi Cekander, Jenna Grasmeyer, Julia Gomez, Katie Hauge, and Jessica Krantz
Mentors: Dr. Maureen Dunn and Dr. Mark Northuis
Department of Kinesiology

The Shuttle MVP™ is a plyometric training device that utilizes resistance bands and a horizontal gliding technique to train muscles of the lower body to increase dynamic jumping power. This training method may be beneficial for many athletes since its design allows for reduced impact on joints, especially in athletes who use jumping on a regular basis such as volleyball and basketball players. Previous research has suggested that 4 weeks of training with the Shuttle MVP™ may increase vertical jump in novice jumpers; however, this device has not been tested on experienced jumpers nor has it been compared to an alternate training technique. Therefore, the purpose of this study was to compare the effectiveness of jump training using the Shuttle MVP™ to the more conventional depth jump method on improvements in vertical jump in experienced college-aged jumpers over a 4-week training period. Twenty Hope College students were matched according to gender, initial vertical jump height, and jumping experience before being assigned to one of three groups; control, depth jump training, and Shuttle MVP™ training. The control group maintained habitual activity throughout the study period, while the two experimental groups trained 3 times per week for 4 weeks. Each training session included a 5 minute warm up followed by a pre-determined number of sets and reps of the designated exercise. Repetitions and sets were increased each week along with the height of the depth jump or resistance level on the Shuttle MVP™. It was hypothesized that the Shuttle MVP™ would show significantly more improvements in maximal vertical jump height compared to the other two groups over the 4-week training period.

The Effect of Sand Versus Grass Plyometric Training on Vertical Jump, Sprint Performance, and Ankle Flexibility

Maria DeShaw and Jenny Langill
Mentor: Dr. Kevin Cole

Plyometric training has become increasingly popular as an alternate type of training for many different sports. Plyometric training embodies the natural movements that are conducted in specific sports, promoting an increase in performance and decreased risk of injury. The purpose of this study is to determine how plyometric training on different surfaces, specifically sand and grass, affect vertical jump, sprint performance, and ankle flexibility. Twenty college students participated in a 4-week plyometric program on a sand or grass training surface. Vertical jump, 20-meter sprint, and ankle flexibility were assessed before and after the training program. The results indicated no significant differences between groups in vertical jump (pre grass: 18.3 +/- 3.49, post grass: 19.4+/- 2.67, pre sand: 20.9 +/- 5.15, post sand: 21.5 +/- 4.42), 20-m sprint (pre grass:

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3.76 +/- .37, post grass: 3.80 +/-.37, pre sand: 3.6 +/- 0.37, post sand: 3.63 +/- 0.44), ankle dorsiflexion (pre grass:15.33 +/- 5.39, post grass: 17 +/- 3.16, pre sand: 14.33 +/- 7.39, post sand: 17 +/- 3.16), and ankle plantarflexion (pre grass: 52.33 +/- 6.47, post grass: 61 +/- 3.31, pre sand: 49.33 +/- 7.53, post sand: 55 +/- 9.41) . However, a trend was observed demonstrating plyometric training can improve vertical jump and ankle flexibility independent of training surface.

Os Trigonum: A Detailed Case Study

Brooke Dippel
Mentor: Professor Margaret Frens
Department of Kinesiology

Os Trigonum, a small boney growth on the posterior aspect of the talus, is a syndrome that affects 10% of the general population. Although often asymptomatic, the active population may experience pain, such as athletes participating in soccer, football, and wrestling. Individuals with a rigid mid-foot or repetitive plantar flexion movement are predisposed to this syndrome. Categorized four ways for identification and treatment, Os Trigonum forms through chronic over-use injuries, traumatic acute injury, or through secondary processes. These categories include a normal presentation, elongated posterior talar process, presence of an accessory bone, and a fused Os Trigonum bone. Symptoms of Os Trigonum include stiffness, weakness, swelling, decreased plantar flexion, posterior deformity, and pain with general ankle movement. The gold standard used is MRI imaging and a full symptoms assessment. Differential diagnoses include Flexor hallicus longus tendinitis, lateral ankle sprain, tarsal tunnel syndrome, subtalar pathology, peroneal tendinopathy, Achilles tendon bursitis, or Osteochondritis dissecans of the talus. The detailed review of a specific case provides a further explanation of this orthopedic complication.

Legg-Calvé-Perthes Disease: A Case Study

Hannah Doorn
Mentor: Professor Margaret Frens
Department of Kinesiology

Legg-Calve-Perthes disease is a form of osteonecrosis in children occurring in the head of the femur. The name originated from Arthur Legg, an American orthopedic surgeon, Jacques Calve, a French orthopedic surgeon, and Georg Perthes, a German orthopedic surgeon. The disease results in a disruption of blood supply to the long bone of the leg, which in turn can then lead to localized cell death. The loss of bone tissue can cause instability in the hip producing an antalgic gait, pain, soft tissue dysfunction, and overall functional disability. The strength and range of motion of the muscles in the buttock and upper leg are decreased over time without treatment. The main treatment options are a wait-and-see approach, non-surgical with rehabilitation, and surgical with repair. The two main surgical options involve cutting and releasing the tendoninous tissue or cutting and repositioning the bone to reduce stress. Various treatment and surgical options will be discussed regarding this particular case study of a 9-year-old female. The study looks into the specifics of the case and the treatments that she received.

Senior Case Presentation: Brostrom Ankle Reconstruction on Chronic Ankle Injury

Andrew Erickson
Mentor: Prof. Margaret Frens

Lateral ankle injuries are one of the most common injuries in sports today. These injuries commonly occur in sports due to "rolling of the ankle" or inversion. The Brostrom ankle surgery is a reconstruction of the lateral ankle ligaments after the ankle has developed chronic instability. This condition can be painful, debilitating and could lead to further trauma to the ankle structure or lower extremity. This surgery option will only be used after conservative treatments have not properly strengthened the ligaments and overall lateral ankle complex. The main ligaments of the lateral complex consist of the anterior talofibular, calcaneofibular, and the posterior talofibular ligaments. The specific clinical ligamentous stress tests to

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determine damage to these ligaments include the Anterior Drawer test, Kleigers test, and the Talar Tilt test. If these tests are positive or complaints of dysfunction are reoccurring, the Brostrom surgery is performed. An MRI is the gold standard for identifying structural damage and determining severity of the ankle trauma. Rehabilitation will be used as a conservative treatment before surgery is prescribed. The rehabilitation will also continue after the surgery in order to restore the strength, range of motion, and mobility. A case study of a collegiate men's basketball player will be reviewed in regards to chronic ankle instability and surgical repair.

The Effects of Dynamic and Ballistic Stretching with Differing Rest Intervals Prior to Vertical Jump in DIII Male Football Players

Ashley Fox, Jamel Gault, and Madison Lachance
Mentors: Dr. Maureen Dunn and Dr. Mark Northius
Department of Kinesiology

Stretching programs are often utilized in sports for injury prevention and to warm-up muscles prior to competition. Varied stretching techniques exist (eg. static, dynamic, and ballistic); however, controversy exists regarding which stretching technique will provide the greatest benefit on subsequent vertical jump height. In addition, little is known regarding how the time interval between stretching and jumping will affect performance. The purpose of this study was to compare the effects of dynamic and ballistic stretching on vertical jump height with differing rest intervals between stretch and vertical jump in DIII male football players. It was hypothesized that dynamic stretching would increase vertical jump height to a greater degree than ballistic stretching, and that vertical jump height would decrease as the length of the rest interval between stretching and jumping increased. Ten DIII male football players aged between 19 and 22 were chosen to participate. After being familiarized with testing and stretching procedures, each participant had his vertical jump height measured 0, 5, 15, and 30 min after both ballistic and dynamic stretching. A minimum of 48 hours separated each testing session. The stretching program and rest interval between stretch and jump were counterbalanced for each participant to rule out any order effects. If results suggest that one stretching protocol is more effective than the other at maximizing vertical jump height, then athletes will be encouraged to use that protocol prior to competitions where they will be jumping (eg. football, volleyball, basketball, etc.). Furthermore, results may also reveal the ideal time interval between stretching and performance.

The Effects of Agility Training with Weighted Vests on Overall Agility Performance in College Students

Kristi Hansen, Leslie Kempers, Katie Afton, and Ally Lubbers
Mentor: Dr. Maureen Dunn
Department of Kinesiology

The purpose of this study was to determine the effects of wearing a weighted vest (10-11% of lean body mass, LBM) during a four-week agility training program on overall agility performance. Fifteen participants (ages 18-22) took part in the study and were actively recruited from Hope College health dynamics classes and out-of-season athletes. All participants performed a pre-test in the T-Test (TT) and Illinois Agility Run Test (IART) before being matched by initial agility score and assigned to either a control group (n=4), weighted-vest group (n=6), or non-vest group (n=5). The two experimental groups participated in the agility training program for 4 weeks while the control participants maintained habitual activity. Various supervised agility exercises were performed during 50-minute training sessions on three days of each week during the training period. We hypothesized that individuals wearing a weighted vest during agility training would improve in agility performance more than those not wearing a weighted vest. Data was collected and analyzed using a 3x2 Repeated Measures ANOVA. Results showed no significant difference between groups or over time from pre to post-test for TT (Pre: 11.30±0.38 sec, Post: 11.08±0.40 sec, $p > 0.05$), but all groups significantly increased pre to post-test for IART (Pre: 18.01±0.49 sec, Post: 17.81±0.54 sec, p =

0.034). There was also no significant difference in heart rates or level of enjoyment between experimental groups throughout the study. According to the data, it can be concluded that weighted vests had no significant effect on agility performance during a four week agility training period in comparison to both the non-vest and control groups.

The Effect of Intensive Up Hill Training in Improving Running Economy in Collegiate Distance Runners

Katie Hauge
Mentor: Dr. Mark Northuis
Department of Kinesiology

The purpose of this study was to compare the effects of high intensity uphill vs. flat ground intervals on running economy in trained collegiate distance runners. The sample population included collegiate cross country athletes that were assigned to either a control group, an uphill interval training group or a flat ground interval training group. The aerobic capacity and running economy of all participants were assessed during pre- and post-testing with a maximal VO2 treadmill and time to exhaustion tests. For the training groups, the 7-week study included a 5-week intervention of 6 workouts per week with two sessions at high intensities. The first of the two workouts was a 20-minute tempo on flat ground, and the second was an interval workout on either a flat or inclined surface depending on the group. Both groups worked at VO2max intensity for these intervals, but the flat ground group ran at a greater velocity. By contrast, the control group ran base miles without high intensity workouts for the duration of the study. Results indicated that uphill training induced gains in VO2 and percent VO2 at lactate threshold that were significantly greater compared with the flat-ground group. In addition, it was found that the flat-ground training group showed gains in velocity and percent velocity at lactate threshold, which significantly differed from the control group. There were no significant differences between the hill training and the control. These results indicate that there is potential benefit to uphill interval training for improving running economy, while any improvements in velocity related variables might require higher workout velocities.

Bilateral Chronic Exertional Compartment Syndrome in a 21-Year-Old Female: A Case Study

Anne Japinga
Mentor: Professor Margaret Frens
Department of Kinesiology

Compartment Syndrome occurs and develops when swelling and bleeding occur in the compartments of the lower leg, and pressure within the muscle builds to high and dangerous levels. For this case, it is also important to understand the anatomy of the lower leg, as well as the possible differential diagnoses. The anatomy of the lower leg consists of four major compartments, comprised of muscles, nerves, arteries, and veins, which are surrounded by fascia. Pressure that results from this condition can decrease blood flow, preventing nourishment and oxygen from reaching distal cellular structures. There are also multiple differential diagnoses involved in this case, which play a large role in how the patient may receive treatment. In this case, a stress fracture, medial tibial stress syndrome, and compartment syndrome were all possible diagnoses. It is important to be aware of the symptoms the athlete presents in order to rule out other conditions. There are two general treatment options for this condition: a conservative and a surgical option. The conservative option consists of cryotherapy, orthotic fitting, reduction of training volume, and potentially rest. The surgical option consists of a fasciotomy, which requires an incision into each involved compartment in order to reduce the level of pressure. However, in this athlete specifically, three surgical operations were necessary over a five year period. Her chronic exertional compartment syndrome was recurring, and the athlete would only remain symptom free for a few months after a surgical operation was performed. An overview of the condition and outcomes from this case will be presented.

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Foundations for Fitness: Initial Outcomes from a 10 Week Multidisciplinary, Pediatric Obesity Intervention

Jessica Krantz and Jorgie Watson
Mentor: Professor Kyle Morrison
Department of Kinesiology

This project was funded by a grant awarded through the Herman Miller Cares Foundation.

Childhood overweight and obesity is a national epidemic and predisposes children to adulthood obesity as well as increases the risk of developing cardiovascular, metabolic, and psychological disorders. Prior research has found that if an individual can engage in lifestyle modification for 10 weeks then the change is more likely to be maintained after the intervention. The purpose of this study was to assess the effectiveness of a 10-week multidisciplinary intervention program on improving the health outcomes of children aged 7-12 years with a body mass index (BMI) greater than the 85th percentile. Child participants were referred from local pediatric care providers and, of the 15 that began the program, 13 participants completed the 10-week training session. Subjects were assessed for resting heart rate, resting blood pressure, BMI, percent body fat, waist circumference, height and weight. Furthermore, participants completed a quality of life survey and the participating parents filled out a questionnaire assessing the obesogenic factors in the household (FNPA). Prior to pre-program evaluations, the parents of participants completed an informed consent form that was approved by the Hope College Human Subjects Review Board. All child participants participated in the exercise portion of the program and each training session consisted of an hour and a half of physical activity once a week led by Hope College physical education students. Parents of participants simultaneously attended educational sessions on lifestyle modification. At the end of the program waist circumference significantly decreased ($p=.027$) and improved scores for the FNPA were trending towards significance. The data from the first cohort of this 10-week intervention program will be presented at the research celebration; meanwhile, data collection from the second cohort of the intervention program is currently ongoing.

Effects of Graduated Compression Tights on Repetitive Vertical Jumping

Jordyn Severt
Mentor: Dr. Kevin Cole
Department of Kinesiology

Wearing compression garments may reduce the severity of delayed onset muscle soreness and decrease the deleterious effects of prior exercise on muscle strength and power. The purpose of this study was to determine the effects of graduated compression tights on repetitive vertical jumping and fatigue in a setting designed to simulate an athletic competition. Five men and five women with a background in power and strength-based competitive sports completed the study. All subjects initially reported to the laboratory for a familiarization session where they were introduced to the warm-up protocol and the procedures for the vertical jump testing. They were then randomly assigned to begin the testing procedures the following week wearing either graduated compression tights or running shorts. For each testing session the subjects dressed in the appropriate attire and then began with a standard dynamic warm-up procedure followed by three maximal vertical jumps separated by 10 seconds each. After these three maximal jumps the subjects performed 12 more vertical jumps with two minutes between jumps to simulate a competition situation. Subjects then rested in a seated position for a two-hour period. This break was provided to simulate the time period between games or track events before more activity takes place. Following the break the subjects repeated the warm up and vertical jump procedure. One week after the first testing session the entire protocol was repeated under the opposite condition. The results will be analyzed to determine if graduated compression tights can delay fatigue and improve repetitive vertical jump scores. The results of this study may be beneficial to anyone seeking to improve performance in strength and power based sports and may help to improve knowledge of mechanisms of action of compression gear on recovery from exercise.

The Effect of Rest Time After Stretching on Vertical Jump Height

Jordyn Severt, Olivia Vacik, Kelsey Baker and Emily Smith
Mentor: Dr. Kevin Cole
Department of Kinesiology

The exact effects of stretching on power production are uncertain. This uncertainty could be due to a lack of control for rest time after stretching before performance. The purpose of this study was to determine the relationship between rest time after stretching and its effect on power production in recreationally active college students. A total of 17 participants volunteered for this study. Each participant performed the same stretch protocol including static and dynamic stretches after jogging for 5-minutes to warm up. Subjects were randomly assigned to groups for different rest intervals before vertical jump (0, 5, 15, 30). In following testing sessions, participants performed the remaining rest intervals until they had performed all four of them. After stretching and allotted rest time, participants jumped three countermovement jumps using the Vertec Apparatus. The highest of the three jump values was their final value. The results were analyzed using a pairwise comparisons test. Mean values were 15.03 inches +/- 4.50 (pre-stretching), 16.68 inches +/- 4.82 (0 minutes rest), 16.38 inches +/- 4.75 (5 minutes rest), 16.44 inches +/- 4.90 (15 minutes rest), and 15.41 inches +/- 3.46 (30 minutes rest). Significant differences were seen in vertical jump performance when comparing the pre-test data to the 0-minute rest condition ($p=0.002$), 5-minute rest condition ($p=0.021$), and 15-minute rest condition ($p=0.012$). Significant differences were also seen when comparing the 0-minute rest condition with the 30-minute rest condition ($p=0.019$). This data shows that our stretching protocol enhanced vertical jump height at 0, 5, and 15 minutes rest. There was also a significant drop in jump height from 0 to 30 minutes, indicating that the beneficial effects of stretching wore off sometime between 15 and 30 minutes rest.

The Effects of Beta Alanine Supplementation on Bench Press Endurance and Isometric Core Endurance Following a 4-Week Training Program

Gavin Sheasley, Ian Nyberg, Will Morlock and Garrett de Waal
Mentor: Dr. Maureen Dunn
Department of Kinesiology

Beta-alanine has previously been shown to improve high-intensity exercise performance in active and sedentary individuals following a training program. The majority of current research pertains to the effects of beta-alanine supplementation on aerobic exercise following a prolonged training program. This study was designed to determine whether 4 weeks of beta-alanine supplementation (BA, n=11) combined with 3 days of resistance training per week would result in greater improvements in muscular endurance compared to placebo (PL, n=10). All participants completed the maximum number of bench press repetitions at 65% 1RM before being matched for muscular endurance and randomly assigned to either BA or PL. Training included 3 successive sets of push-ups to muscular fatigue followed by 3 timed planks. It was hypothesized that beta-alanine supplementation would improve bench press endurance and isometric core endurance due to its ergogenic properties of increasing muscle carnosine concentration. Results displayed improvements in bench press repetitions to failure at 65% 1RM in both groups, (pre: BA= 14.7 ± 1.0, PL=15.0 ± 1.1; post: BA=21.0 ± 1.1, PL=16.8 ± 1.2, $p<0.0001$) with significantly greater improvements in the BA group ($p < 0.0001$). Both groups improved in isometric core hold time (seconds) to failure (pre: BA = 51.3 ± 7.6, PL = 63.8 ± 8.0; post: BA = 69.4 ± 9.6, PL = 75.3 ± 10.1, $p<0.0001$) but no significant difference existed between groups ($p = 0.286$). The study concluded that 4 weeks of beta-alanine supplementation combined with 4-weeks of muscular endurance training significantly increased bench press endurance at 65% 1RM.

POLITICAL SCIENCE

U.S. Liberals in a Realist World

Shubham Sapkota
Mentor: Dr. Jack Holmes
Department of Political Science

Through the analysis of American business liberal and reform liberal thinking during the extrovert phases from 1798-1967, this research will present realist suggestions for the long-term. While each phase of introversion or extroversion is unique, past patterns remain relevant. After upcoming introversion has run its course, transition to extroversion is likely as it happened in 1940 and 1989. Without making policy changes, the US will not be able to promote their long-term national interests. In order to keep consistency with the changing world order, the US has to increasingly put effort in dealing with both domestic as well as international issues. This research brings into attention how the US needs to deal with the changing dynamics of political and military strength. This includes more focused attention on issues of economy, security, and environment during a time of increasing globalism. At the same time it is to contain the threats facing the US. If that is not possible, the past can help identify future challenges. The long-term analysis in this paper is a valuable supplement to short-term analysis.

Jenna Grasmeyer, Kinesiology

Jessica Krantz, Kinesiology

Jordan Hoogerhyde, Kinesiology

Fallon Richie, Psychology

Shengjie Chen, Psychology

Impact of a Nature-Based Science Enrichment Program for Preschoolers on Body Mass Index and Activity Preferences

Bailey Chapman, Brandon Tarallo, Jordan Taylor, Allie Chinander, Sarah Thoman, Hillary Smith, Rebekah Givens, and Jordan VanderLeest
Mentor: Dr. Sonja Trent-Brown
Department of Psychology

This research was funded by a grant from the Kellogg Foundation.

This study explores children's health as it relates to Body Mass Index (BMI), sedentary or active play prferences, and solitary versus active social play. To find the interrelatedness between the variables, 400 preschool children aged 3-5 from West Michigan schools were interviewed. BMI was assessed using portable stadiometers and digital scales. The BMI percentiles and the BMI of each student was calculated by utilizing the Centers for Disease Control BMI Tool for School Groups calculator in addition to their heights and weights. A face to face interview was conducted to measure the sedentary versus active play preferences and to gain insight into the children's preferences for active or sedentary activities when participating with family and friend groups as compared to solitary playing. The interview collected data based on questions such as, "What is your favorite thing to do with your friends and family?" and "What types of things do you like to do when you are alone (by yourself)?" A negative correlation was predicted for BMI and activity preference such that participants with higher BMIs were more likely to prefer sedentary activities. We expected statistical analysis to demonstrate that children in a social atmosphere were more likely to engage in active play and when they engaged in solitary play they would tend toward more sedentary activities. If the data provides evidence that BMI is associated with one's preferred choice of activity for preschoolers, it will support previous findings that BMI is negatively correlated with higher levels of physical activity for other age groups. If our hypothesis regarding social versus solitary play is supported such that group activity encourages a more active preference, this has implications for community programming initiatives and for parent education encouraging group play in order to yield higher levels of physical activity.

The Meaning of Hope: Faith and Flourishing

Shengjie Chen and Katelyn Klotz
Mentor: Dr. Charlotte Witvliet
Department of Psychology

The spiritual dimension of hope has been less emphasized in previous investigations. This study built upon empirical work on prayer (Sandage et al., 2011) and hope as important variables connecting faith to mental health (Chang et al., 2013). College students (175 F, 80 M) completed a survey containing state and trait measures of hope and hopelessness, as well as two newly developed scales of hopeful spiritual beliefs, one addressing hope which transcends death, and one which measures hopeful prayer. We also used measures of meaning in life, religiosity/spirituality, religious commitment, attitudes toward God, religious coping, and flourishing. First, we tested hope-related measures in relation to meaning, spiritual, and religious variables. Correlational analyses found that hope-related measures had statistically significant positive correlations with each meaning, spiritual, and religious variable. Hopelessness had inverse and significant correlations with these variables. Second, we conducted multiple regression analyses to determine whether trait hope-related measures accounted for significant variance in scores on faith measures. Trait hope-related measures accounted for more than half of the variance in religious commitment scores, positive attitudes towards God scores, and positive religious coping scores. Of all hope-related measures, hopelessness was the best predictor of meaning in life. Hopeful spiritual beliefs best predicted positive religious coping, positive attitudes toward God, and religious commitment. Lastly, we aimed to determine if hopeful prayer mediated the relationship between religious coping with a past difficult event and current levels of flourishing. The mediation model showed that hopeful prayer mediated the relationship between

religious coping (with a past difficult event) and current flourishing. These findings substantially contribute to a multidimensional understanding of hope as strongly connected with spirituality and religiosity in a flourishing life. This research suggests that individuals who have experienced a past difficult event can still flourish through hopeful prayer.

Gratitude and Hope: A Two-Way Street

Shengjie Chen and Nicholas Pikaart
Mentor: Dr. Charlotte Witvliet
Department of Psychology

This study examined hope in relationship to other human strengths such as gratitude, self-control forgiveness, and patience. The purposes of this study were to 1) test whether hope-related measures were significant predictors of other human strengths, 2) determine which strengths best predicted hope, and 3) test hope against self-control to determine which was the strongest predictor of gratitude, forgiveness (of self and others), and patience. A sample of undergraduates (N=175 F, 80 M) completed self-reported trait measures of cognitive hope, comprehensive hope, hopelessness, gratitude, self-forgiveness, forgiveness of others, patience, and self-control. Trait hope measures were significantly and positively correlated with trait measures of gratitude, self-control forgiveness of others, self-forgiveness, and patience. Trait hopelessness was inversely correlated with each of these strengths. Multiple regressions showed that trait measures of hope and hopelessness together accounted for greater variance in gratitude scores than self-control, followed by self-forgiveness, forgiveness of others, and patience scores. Of the three hope-related measures, comprehensive trait hope was the best predictor of gratitude and forgiveness of others, whereas trait hopelessness best predicted self-forgiveness and self-control. Of all of the strengths measures, gratitude was the best predictor of cognitive trait hope, comprehensive trait hope, and trait hopelessness. This study advances positive psychology by presenting hope as a significant predictor of other human strengths. Hope was strongest in predicting gratitude, and gratitude significantly predicted each hope and hopelessness measure. This suggests that cultivating genuine hope may increase levels of gratitude, and that bolstering gratitude may generate hope.

The Role of Meaning in Attitudes toward Evolution

Anne-Lynn Dillman, Paige Garwood, and Sarah Peterson
Mentor: Dr. Daryl Van Tongeren
Department of Psychology

This research was supported by a grant from the John Templeton Foundation.

Humans seek to have meaning in their lives. Worldviews, such as science and religion, help structure one's world and provide meaning. Both the Meaning Maintenance Model (Heine, Proulx, & Vohs, 2006) and Terror Management Theory, suggest the importance of meaning (Greenberg, Pyszczynski, & Solomon, 1986). Threats to one's meaning create existential anxiety, which causes one to reject competing worldviews (Greenberg et al., 1990). Worldviews manage existential anxiety by providing order and security (Rosenblatt et al., 1989). This existential anxiety and the need to validate our meaning may cause tension between competing worldviews—particularly between science and religion. Data were collected from a sample of 197 community members and Hope College students combined. Participants were randomly assigned to one of three conditions: meaning affirmation, meaning challenge, or control. Participants completed questionnaires regarding their views towards religion, science, and meaning in life. Next, participants read a fabricated essay, supposedly written by a Harvard scholar. Depending on condition, the essay addressed life's importance (affirmation), life's meaninglessness (challenge), or computers (control). Participants then completed measures of biased thinking. Next, participants read a mixed-evidence essay on evolution, rated the essay, and

completed questionnaires regarding their attitude toward evolution. Participants also completed measures regarding their attitudes toward science, religion, and evolution again. Participants were then debriefed. Our hypotheses were supported and the results revealed that threats to meaning enhance biases. We also found that participants who hold religious beliefs centered on God's protection and promises of specialness perceived the mixed-evidence essay to be significantly more critical of evolution when their meaning was threatened. This supports our hypothesis that meaning threats elicit worldview-consistent information processing, resulting in more negative attitudes towards evolution. This study shows that when our life's meaning is challenged, we rely so much on our own worldviews that we dismiss divergent worldviews.

The Effects of Existential Threats and Relationship Security on Social Attitudes

Paige Garwood, Evan Johnson, Sarah Peterson, Anne-Lynn Dillman, Hanna Newbound, and Alexa Rencis
Mentor: Dr. Daryl Van Tongeren
Department of Psychology

This research was supported by a grant from the John Templeton Foundation.

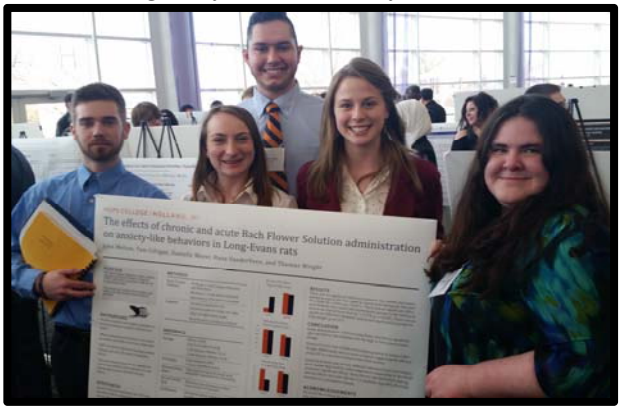
Human beings function best when they have a sense of meaning in their lives. We imbue meaning to things in our lives as a shield against our overwhelming fear of death (Greenberg, Pyszczynski, & Solomon, 1986). After facing thoughts of death, it has been suggested that one increases defensiveness towards outgroup members (Van Tongeren, Green, Davis, Worthington, & Reid). Past research has indicated that relationship commitment correlates with a range of positive psychological outcomes. In the present study, our aim is to determine whether positive relationships act as a terror management mechanism to decrease defensiveness towards members of the out-group (feminists). We hypothesize that priming a secure relationship and thoughts about physical pain will lead to less negative ratings of an out-group member (confederate posing as a feminist) than the ratings of a participant primed with an insecure relationship and thoughts about their own death. After completing a series of individual difference measures, participants were randomly assigned to one of four conditions (secure relationship/physical pain; secure relationship/death; insecure relationship/physical pain; insecure relationship/death). Both primes consisted of a writing activity. Following this, participants completed another series of relationship and outcome measures. Once completing the packet, participants were directed to a room to be debriefed by a lab assistant wearing a shirt that read, "this is what a feminist looks like." After the debriefing, participants were to evaluate the RA. We discuss our findings and the implications of our research. This study will contribute to the understanding of Terror Management Theory and what potential safeguards might be beneficial.

Effects of Acute Bach Flower Administration on Anxiety-like Behaviors in Long-Evans Rats

Tamara Gilligan, John Melton, Danielle Meyer, Hana VanderVeen and Thomas Wright
Mentor: Dr. Sonja Trent-Brown
Department of Psychology

Herbal remedies are becoming increasingly popular with the general public but are not often subjected to rigorous experimental trials; therefore, determining their effectiveness as a treatment option poses a challenge. To test the claim that Bach Flower Remedies have anxiolytic properties, we designed an experiment to study the effects of acute Bach Flower Solution administration on anxiety-like behaviors in 20 male Long-Evans rats. Bach Flower Solution is a mixture of 40 drops (~2ml) of herbal extracts such as Aspen, Mimulus, Rock Rose, and 80 drops (~40ml) of a proprietary mix called Rescue Remedy that were dissolved in a 27% ethanol solution. The rats were orally dosed with Bach Flower Solution or a control solution for two days weekly and underwent behavioral testing on the second day of each week. Dosage concentrations were increased ten-fold for the third and fourth weeks of testing. Two well-known methods of behavioral testing in rats were used: the Elevated Plus Maze (EPM) for anxiety-like

behaviors and the Forced Swim Test (FST) for depression-like behaviors. The EPM consisted of 5 minute trials per subject and the FST consisted of 10 minute trials per subject. Previous testing conducted on the effects of chronic treatment using the same Bach Flower Solution elicited significant results during the EPM. Thus, it was hypothesized that acute dosage of Bach Flower Solution would significantly reduce anxiety-like behaviors in rat models, defined by increased time spent in the open arms of the EPM, as well as decreased total float time and longer latency to float in the FST. Results from the EPM and FST were not significant for the lower or higher concentration dosages. Expanding the quantity and quality of research in this field may open up new possibilities for clinical treatment of anxiety disorders that could greatly benefit society.



John Melton, Thomas Wright, Tam Gilligan, Hana VanderVeen, and Danielle Meyer at the MASAL conference.

Examining the Relationship Between BMI and Academic Performance

Rebekah Givens, Hillary Smith, Jordan Taylor, Jordan VanderLeest, Allie Chinander, Bailey Chapman, Sarah Thoman, and Brandon Tarallo
Mentor: Dr. Sonja Trent-Brown
Department of Psychology

This research was funded by a grant from the Kellogg Foundation.

Evidence regarding the direct effect of weight on academic achievement is not entirely conclusive; however it is clear that overweight students face additional barriers to learning. These barriers are likely to contribute to a diminished academic performance among overweight students (Action for Healthy Kids, 2004). Although previous literature indicates links between activity preference and academic performance, as well as between activity preference and obesity (Action for Healthy Kids, 2004), it is still uncertain whether or not a direct link exists between Body Mass Index (BMI) and academic performance. The present study assesses BMI, activity preference, and early literacy development as measures of participants' health, activity level and academic performance. BMI was calculated using the height and weight obtained from participants. The Preschool Early Literacy Indicators (PELI) assesses early literacy skills for preschool-aged children. Activity preference, as measured by Leary's Preschool Activity Preference (2009), evaluates participants' preference for active or sedentary activities. Participants consisted of over 400 preschool students from various preschools located in West Michigan. This current study suggests an inverse relationship between BMI and academic performance, specifically that high BMI relates to low PELI scores. In order to do so, it is first necessary to demonstrate that the positive relationship between activity preference and academic performance and the inverse relationship between activity preference and BMI exists within the current data. In demonstrating the existence of these relationships this study seeks to remove activity preference as a primary indicator of low PELI scores, suggesting instead a direct inverse relationship between high BMI and low PELI scores. If supported, this inverse relationship suggests that BMI is a primary indicator of academic performance.

Implicit Desires vs. Explicit Preferences: What Matters More for Mate Selection?

Samantha Grody, Nicki Hames, Ivy Keen, Allison Kleppinger, and Tara Murray
Mentor: Dr. Carrie Bredow
Department of Psychology

To date, most research on mate selection has focused on identifying what people say they want in a partner, with the assumption that these criteria guide people's partnering decisions and behaviors. Recent research, however, suggests that this may not always be the case. Despite evidence that greater correspondence between a priori mate standards and partner characteristics is linked to greater relationship quality, other work has found little to no correlation between the traits people report valuing most in a mate and the types of partners they actually select. One explanation for this lack of correspondence between reported standards and partnering behaviors is that some attitudes that influence people's relational decision-making may not be consciously accessible. However, only one study has examined mate preferences in an indirect (implicit) manner, and this investigation focused only on whether implicit preferences for physical attractiveness predicted evaluations of potential partners in initial encounters. Our research seeks to address these limitations by assessing implicit preferences for three major trait dimensions and examining whether such measures can meaningfully predict evaluations of existing romantic relationships. Approximately 200 unmarried individuals recruited from classes at Hope College engaged in two implicit procedures (SC-IAT and IAT) designed to capture the strength of their spontaneous reactions to different traits in a partner. Participants also completed a self-report survey assessing their explicit standards for a long-term partner, their own characteristics, and their evaluations of their romantic relationships (if partnered). Preliminary results indicate that although all three attribute dimensions elicited generally positive affective reactions, males revealed stronger implicit preferences for physical attractiveness/vitality than did females and were more likely than females to implicitly value attractiveness/vitality over warmth/dependability. Initial tests of the connections between implicit preferences and (a) explicit mate standards, (b) self-reported traits, and (c) relationship evaluations were inconsistent and await further analysis.

Stable Standards or Fluctuating Fancies? Stability and Change in People's Mate Criteria Over 28 Months

Nicki Hames
Mentor: Dr. Carrie Bredow
Department of Psychology

Past research on mate standards has generally been built on the assumption that people's mate standards are relatively stable over time, and that the criteria people report at one point in time should predict their future partnering behavior. However, very few studies have directly examined the temporal stability of standards and those that have have found that although standards are fairly stable overall, there appears to be notable variation in this stability (e.g., Zentner, 2005). The current study builds on this research by exploring factors that may help explain for whom and under what conditions mate standards are stable over time. A sample of 285 unmarried, heterosexuals (71.93% women; *M* age = 30.52) were recruited from college night courses, community organizations, and social media sites. Participants completed an initial online survey and three follow-up surveys at 9 to 10-month intervals. Although mate standards were moderately to strongly correlated across the four time points (reflecting rank-order stability; *r*s = .51-.74), t-tests revealed significant mean-level increases from T1 to T4 on all standard dimensions. Individual growth curve modeling showed that, on average, participants' standards followed a positive linear trajectory, but that there was significant variability in this pattern. As hypothesized, individuals who were older reported more stable standards than younger people over 28 months with respect to rank-order and mean-level stability, however age did not

have an effect on individual-level stability (i.e., the rate of change in standards over time was not significantly lower for older participants). No consistent gender differences in stability were found across any of the standard dimensions. Taken together, these results show that despite an overall pattern of stability, change did occur, especially among younger individuals. To the extent that younger individuals' standards fluctuate over time, mate standards may be minimally useful in predicting their future partnering behavior.

Treatments for Depression: Reactions and New Approaches

Amy Hoag
Mentor: Dr. Sonja Trent-Brown
Department of Psychology

The overarching question for this project was whether S-adenosylmethionine (SAMe) could be a more effective, less side-effect-ridden treatment for depression as compared to Selective Serotonin Reuptake Inhibitors. Pertinent to this topic is the evaluation of traditional treatment approaches and whether individuals feel that their experiences with these treatments have been successful. A survey was developed to assess individuals' typical reactions to life stressors and whether they have a history of depression as well. Assessing the popularity of antidepressants is imperative, for it determines whether a new treatment for depression will benefit the general public. Three samples of participants were included in the study. The first sample was drawn from undergraduate students, the second from patients currently undergoing treatment, and the final sample was from online participants ages 18-65. It was expected that participants with depression would be dissatisfied with their current treatment. Of particular interest was exploring the relationships among the variables in the study (e.g. social connectedness, physiological state, stress responses) and determining the extent to which responses to depression varied with respect to gender and age. It was expected that women would be more likely to exhibit dissatisfaction with their current treatment due to the social stigma against men regarding openness about emotional stress. It was also expected that people under the age of 26 would be less satisfied with traditional treatments as compared to older participants who may have adapted to their treatments. Finally, it was expected that inpatients would be less satisfied with treatments than outpatients. In addition to the survey component, there was an interview aspect of the study. Interviews were conducted with professionals involved in the study and treatment of depression. Expectations were that interviewees would provide greater insight into the benefits of SAMe as compared to alternative treatments for depression.

Suicidality and Relationship with Self, Others, God, and Environment

In Hyuk Hwang
Mentor: Dr. Sonja Trent-Brown
Department of Psychology

The state of mental health in South Korea is very poor, where a flourishing mental health state is rare and a struggling one is the norm. Suicide statistics in Korea are the highest among Organisation for Economic Co-operation and Development (OECD) nations, with statistics of students' happiness ranking Korea at the bottom of the world alongside third-world countries. Studies show that the old and the young, specifically, high school students, are two of the most vulnerable populations in this suicide epidemic. To contribute to the on-going conversation of research on the mental health of students in South Korea, this study examines a South Korean high school student's relationship with themselves, with others, with God, and with their current environment in conjunction with their suicidality. An online survey was developed for high school students in South Korea. The survey was also completed by two groups of undergraduate students who either had or did not have experience in Korean

high schools. The expected results from the study include that suicidality will have an inversely correlated relationship with all four of the relationship variables, that a selected high school's academic prestige and choice of educational system will both have a significant relationship with suicidality, and that age, more specifically, a student's grade level in high school, will have a significant positive correlation with suicidality. The study will increase our awareness and understanding of a Korean high school student's suicidality and relationships, and may have valuable and potentially life-saving implications in how we learn and adapt.

Hope Matters: Mental Health in College Students

Katelyn Klotz, Nick Pikaart, and Fallon Richie
Mentor: Dr. Charlotte Witvliet
Department of Psychology

A growing body of research has documented the positive implications of hope for well-being. C.R. Snyder and colleagues viewed hope cognitively as goal-focused, emphasizing way-power (pathways to reach a goal) and willpower (motivation to achieve a goal; Snyder, Rand, & Signon, 2002). Scioli et al. (2011) viewed hope comprehensively, rooting it in motivation, emotion, relationships, and spirituality. By contrast, Dunn et al. (2014) described hopelessness as a negative view of important future outcomes. College students (N=255; 69% Female, 31% Male) completed an online survey containing self-report measures of hope (Snyder et al., 1996; Scioli, 2011) and hopelessness (Dunn et al., 2014). The survey also measured mental health and illness variables such as meaning in life, satisfaction with life, flourishing, depression, and anxiety. First, we assessed correlations between state hope and mental health variables. As hypothesized, cognitive and comprehensive hope were positively correlated with meaning in life, satisfaction with life, and flourishing. Hope measures were inversely correlated with depression and anxiety. Opposite patterns occurred for hopelessness. Second, we tested whether cognitive hope, comprehensive hope, and hopelessness together accounted for a significant proportion of variance in flourishing scores. In support of this hypothesis, the three hope-related measures accounted for a significant amount of the variance in flourishing scores. Finally, we replicated and extended research by Venning et al. (2011) and tested whether hope-related variables or depression and anxiety symptoms better predicted flourishing mental health (Keyes, 2007). Importantly, a multiple regression analysis indicated that hope measures were significant predictors of flourishing mental health, going above and beyond measures of depression and anxiety. These findings have theoretical and applied implications, and may provide empirical support for clinicians to promote flourishing mental health through cultivating genuine hope.

Learning to Reappraise or to Accept? The Effects of Acceptance and Reappraisal Training on Emotion, Mental Health, and Physiology

Brittany Lawson, Kaitlyn Mulder, and Erin Farrell

Existing research has shown that adaptive emotion regulation strategies (e.g., acceptance, reappraisal) reduce physiological reactivity, and are negatively related to psychopathology and positively related to self-report. This study examines the effectiveness of training participants to use either reappraisal or acceptance after a transgression. We predicted reappraisal would produce the most positive outcomes, followed by acceptance. In this study, participants (N = 90) identified an interpersonal transgression within the past year and attended two visits, one week apart. We randomly assigned participants to a condition (reappraisal, acceptance, control). Participants described the transgression, completed self-report measures, and engaged in imagery during each visit. Physiology was monitored during 120s imagery trials. All participants

Mentor: Dr. Lindsey Root Luna
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This research was supported by the Jacob E. Nyenhuis Student/Faculty Collaborative Summer Grant and the Frost Research Center at Hope College.

completed baseline and rumination trials; participants in the acceptance and reappraisal groups implemented their strategies in the final trial while controls ruminated again. Using a mixed-design ANOVA (3 Condition X 2 Visit) the data revealed significant decreases in blame, rumination, and anxiety between visits while benevolence, acceptance, emotional flexibility, and life satisfaction increased. During visit one, imagery, accepters reported significantly less sadness and more happiness and peace. During visit two, reappraisers reported less anger and more gratitude and joy while preliminary physiological data showed interaction effects for blood pressure; reappraisers experienced greater reductions. Overall, participants in all three conditions benefited from the study; for example, thinking about the transgression positively impacted rumination, anxiety and life satisfaction. When comparing the specific strategies, acceptance resulted in more immediate impacts (e.g., reductions in arousal and negative emotion), while reappraisal impacted cardiovascular functioning in the short term and more sustained emotional impacts, potentially moving participants toward greater forgiveness of their offenders.

Implications of Language Experience on Accuracy of Speaker Identification

Raquel Mendizabal
Mentor: Dr. Sonja Trent-Brown
Department of Psychology

This research was supported by the Jacob E. Nyenhuis Student/Faculty Collaborativee Research Grant.

Past studies on speaker identification suggest that listeners can identify speaker ethnicity and gender from auditory information (Lass et. al., 1979; Thomas & Reaser, 2004; Perrachione et. al., 2008). A collateral finding of a study examining the effects of phonetic complexity structure and temporal manipulation on ability to identify speakers was that female listeners were significantly more accurate than male listeners in identifying speakers (Trent-Brown et. al., 2011). This finding suggests that listener characteristics might affect accuracy of speaker identification. Our research examined the extent to which language experience affects listeners' accuracy of speaker identification. We hypothesized that participants who had lived in more places and more regions would be more accurate in identifying speakers. We expected that participants who had lived in places with a higher European American population would more accurately identify European American speakers and participants who had lived in places with a higher African American population would more accurately identify African American speakers. We predicted that multilingual participants, having greater exposure to linguistic variation, would have higher accuracy in speaker identification. This study will show the impact of language experience on accuracy of identifying a speaker's gender and ethnicity. The implications of the results can extend to issues of person perception, impression management, and implicit bias in institutions. Accuracy in recognizing a speaker's ethnicity or gender based on language experience could lead listeners to make stereotypical assumptions, which could hinder or increase the chances for an applicant's occupational mobility and success.

Problem Drinking and Self-Forgiveness in College Students

Sarah Peterson
Mentor: Dr. Daryl Van Tongeren

Research in the field of forgiveness has been growing over the past two decades or so, with research on self-forgiveness comprising a fraction of this work (Enright, 1996; Hall & Fincham, 2005; Wohl, Deshea, & Wahkinney, 2008). While the research on self-forgiveness itself is somewhat minimal, there are even fewer studies examining the benefits of self-forgiveness for specific transgressions, particularly regarding addictive behaviors, such as problem drinking. This study aimed to assess the link between forgiving the self for a transgression committed after consuming alcohol and the decision to drink again. Using an online survey

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methodology, we assessed personality factors such as shame- and guilt-proneness, impulsivity, and typical drinking behaviors. We then asked participants to write about a time when their drinking had a negative effect on their relationships with others. Participants were then randomly assigned to either go through a self-forgiveness reflection or a neutral reflection about their transgression. They then were assessed on a variety of self-forgiveness scales, as well as their propensity to drink in the future. Results indicated that although there were no main effects, further analyses revealed several moderators of the relationship between self-forgiveness and problem drinking—specifically the extent to which participants thought the transgression was caused by their drinking, as well as participants' propensity to drink to intoxication. These results suggest that the relationship between self-forgiveness and problem drinking is complex and depends on several specific behavioral and cognitive factors. Future research should explore these factors in more detail to give a more detailed account of how we respond after committing a transgression mitigated by alcohol.

Pessimists Can Thrive, Too: State Hope Improves Mental Health

Fallon Richie
Mentor: Dr. Charlotte Witvliet
Department of Psychology

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

In positive psychology, the predominant conceptualization of hope focuses on specific future outcomes, which are achieved through willpower (the motivation to achieve a goal) and way-power (the ability to find many routes to reach a goal; Snyder et al., 1996). Optimism is the general expectancy of positive outcomes (Scheier, Carver, & Bridges, 1994). Chang et al. (2013) examined the intersection of trait hope and optimism-pessimism for predicting depression in adult, primary-care patients. Our purpose was to replicate and extend their findings in college students, predicting depression and flourishing. College students (N=255) completed self-report measures of state hope and hopelessness (Snyder et al., 1996; Dunn et al., 2014), and optimism-pessimism (Scheier et al., 1994). Scores were centered to reflect high and low levels of hope and hopelessness, and distinguish optimistic from pessimistic participants. Stepwise regression analyses tested our variables as independent and interacting predictors of depression and flourishing. State hope, state hopelessness, and optimism-pessimism were independent predictors of depressive symptoms and flourishing. The significant interactions between each hope measure and optimism-pessimism indicated that the impact of state hope and hopelessness was more potent in pessimists than in optimists. In pessimistic participants that had high state hope or low state hopelessness, levels of depression and flourishing approached those that had otherwise been associated only with optimists. We discovered state hope's powerful undoing effect on depression, as well as its ability to boost levels of flourishing in pessimistic young adults. These findings have applied implications for mental healthcare professionals who work with college students. The findings suggest that promoting the cultivation of genuine hope and of eroding hopelessness each play significant roles in decreasing mental illness and increasing mental health. Specifically, states of increased hope and decreased hopelessness can significantly alleviate depression symptoms and promote flourishing even in pessimistic students.

Flipping for Technology? Student Attitudes toward the Flipped Classroom

Fallon Richie
Mentors: Dr. Patricia Roehling and Dr. Lindsey Root Luna
Department of Psychology

This research was supported in part by a grant to Hope College from the Howard Hughes Medical Institute through the Undergraduate Science Education Program.

Theoretically, the flipped classroom allows students to work at their own paces, lets instructors use class time more engagingly and efficiently, and increases instructor-student interactions (Herreid & Schiller, 2013). However, research regarding flipped classroom advantages is inconclusive; in some studies, students have found the classroom activities and pre-recorded lectures to be extremely worthwhile and engaging (Critz & Knight, 2013) while other studies have found no difference in student evaluations between the flipped and traditional classrooms (Davies, Dean & Ball, 2013). Furthermore, most of the research has studied the flipped classroom in STEM courses. The purpose of our study was to examine student attitudes towards the flipped classroom in Introduction to Psychology. We also sought to identify factors that predicted student preferences regarding the flipped classroom. In a repeated measures design, attitudes towards the flipped classroom were assessed from a sample of 131 (68.9% female) Introductory Psychology students. Four different modules (research methods, sensation and perception, learning, and personality) were flipped over the course of the semester. We found that more than half of students believed that the flipped classroom was more interesting (57.0%) than lecture. However, a slight majority of students preferred the lecture style classroom (56.2%) and about half reported that the lecture was more effective in helping them learn the material. Despite this, the majority of students recommended using the flipped classroom teaching method (93.2%) to some degree. The largest percentage of students recommended keeping the current ratio of flipped classes and lectures. In examining factors that predicted attitudes, students with lower GPAs tended to prefer the flipped classroom format more than the lecture. Similarly, students with lower exam scores preferred the flipped format to the lecture format. Finally, extroverted students preferred the flipped classroom more than introverted students.

Exploration of the Role of a Foster Parent

Brandon Tarallo
Mentor: Dr. Sonja Trent-Brown
Department of Psychology

One of the most damaged areas in American society today is the foster care system. There are many factors that contribute to the issues within the system, and change seems to occur very slowly for those who suffer the most. One of the key roles meant to uplift those in the foster care system is the role of the foster parent who is assigned to both provide and care for the children placed in their home. However, these responsibilities often prove much harder than many foster parents expect. As a result, some foster children fall even further behind. In order to understand the difficulties foster parents face within the foster care system, one must first know how the temporary parent role fits into the overall foster care structure. At that point, their responsibilities can be better understood and the challenges within their roles may be more effectively addressed.

Influence of a Nature-Based Science Enrichment Program on Early Childhood Activity Preferences

Jordan Taylor, Allie Chinander, Bailey Chapman,

Previous research has been dedicated to the increasingly sedentary child population and the interventions necessary for navigating the obesity epidemic children are facing. Currently, children spend less time in outside play than previous generations (Clements, 2004). Additionally, 23% of children today do not participate in any organized or free-time physical activity, with 83% of children receiving nearly 2 hours per day of screen time (Rideout & Hamel, 2006; CDC, 2003). This correlates with increasing obesity rates, with childhood obesity increasing from 4% to 20% from 1960 to 2004 (CDC, 2006). It has also been revealed that interventions can have implications for children's activity

Hillary Smith, Sarah Thoman, Jordan VanderLeest, Rebekah Givens, and Brandon Tarallo
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preferences, encouraging them to engage in more active and outdoor behavior. This study investigated the influence of a nature-based science enrichment program on the activity preferences of students in early childhood classrooms. Over 400 students were recruited to participate in active lessons focusing on nature implemented by a naturalist educator. Prior to the intervention, investigators conducted interviews with the children in order to determine baseline activity preferences. Participants were presented with two pictures of contrasting activities and asked to choose which one they preferred, which were classified as active/outdoor versus sedentary/indoor. In addition, a post-interview will be conducted to determine the children's activity preferences after receiving the nature-based program for comparison to pre-test data. We predicted that children who participated in the intervention would have significantly higher preferences for active and outdoor activities versus indoor and sedentary activities. These results would reveal the necessity for nature-based lessons in early childhood classrooms. As students are exposed to more outdoor activities, they become more inclined to develop active and outdoor lifestyles. This could aid in counteracting childhood obesity as students may spend less time in sedentary activities and participate in more physical activities.

Preschool Participation in a Nature-based Science Enrichment Program: Evaluation of Children's Activity Preference, Literacy Skills, and Development

Sarah Thoman, Jordan VanderLeest, Bailey Chapman, Allie Chinander, Jordan Taylor, Hillary Smith, Rebekah Givens, and Brandon Tarallo
Mentor: Dr. Sonja Trent-Brown
Department of Psychology

This research was funded by a grant from the Kellogg Foundation.

This study examines the physical and intellectual effects of a nature-based science enrichment program for preschool-aged children. The current study looks at the relationship between active outdoor preferences and academic performance. We expect that children who participate in the nature-based enrichment program will demonstrate greater literacy skills and development. Participation in the program should lead to increased outdoor activity preferences. Past studies have shown that sacrificing classroom time for physical activity corresponds with positive academic performance (Robert, 2007, p.2). Thus, inclusion of outdoor education is likely to demonstrate positive effects. Participants were recruited from local preschools on the basis of grant funding from the Kellogg Foundation and the Outdoor Discovery Center in Holland, Michigan. Participants were males and females ages 3-5 years old. Activity preferences were evaluated using an adaption of Leary's Preschool Activity Preferences measure (2009). This specific measure includes children's preference toward sedentary indoor or active outdoor activities. Academic performance will be assessed using the Preschool Early Literacy Indicators (PELI) assessment. The PELI examines early literacy skills in a storybook format (Kaminski, Abbott, Bravo-Aguayo, Latimer, & Good, 2013). The Ages and Stages Questionnaire (ASQ) was used to examine developmental stages. The ASQ examines developmental and social-emotional characteristics of young children (Brookes Publishing, 2014). Higher PELI and ASQ scores correspond with greater skills development. Expected outcomes are that greater literacy skills will positively correlate with development, through comparison of PELI and ASQ scores. Outdoor activity preference will correlate positively with higher PELI scores. Additionally, outdoor activity preference will positively correlate with higher ASQ scores. Outcomes of this study will show the effectiveness of a nature-based science enrichment program for use in future preschool educational planning.

SOCIOLOGY

Public Perceptions of Wolves and Their Return to the Great Lakes State

Ethan Gibbons, and Christopher Seto
Mentor: Dr. Roger Nemeth
Department of Sociology and Social Work

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

Canis lupus, or the Gray wolf, as an apex predator, can certainly be a danger to humans. However, the common perception of wolves as malevolent and evil creatures has been socially constructed through ancient myths as well as contemporary media portrayals. In the early history of the United States, wolf populations were nearly destroyed and only recently has this animal made a return in the Great Lakes Region. This project was a survey of Michigan residents that assessed their knowledge, attitudes, and perceptions (KAP) of wolves. The research also gathered information about the demographics of respondents as well as their positions on two proposals in the November election. The purpose of Proposal One in the election was to determine whether Public Act 520, an act allowing for a wolf hunt in the state of Michigan, would be upheld. The purpose of Proposal Two was to determine whether Public Act 21, a law giving the Natural Resources Commission the power to designate game species, would be upheld. Our research predicted Proposal One within 1% and Proposal Two within 4%. The demographic data gathered in the survey along with the KAP data was analyzed to determine any relationships there were between variables. Among others, significant relationships were found between education, knowledge about wolves, and fear of wolves. The research indicates the importance of public perception and education in the protection of important environmental assets such as wolves.

And the Internet Went Wild: Social Psychological and Social Conflict Functions of the Vaccine Debate

Ethan Gibbons
Mentor: Dr. Pamela Koch
Department of Sociology and Social Work

This research was sponsored by support from a Jaconb E. Nyenhuis Student/Faculty Collaborative Research Grant.

The introduction of vaccines has been hailed by the medical field as one of the biggest public health victories of human history. Despite greatly declining rates of vaccine-preventable diseases, there is a growing movement against vaccinations. A growing number of parents are choosing to forego vaccines for their children altogether or to determine their own schedule of vaccines in lieu of what is recommended. This issue has sparked an incredible amount of polarization and conflict. The Internet has become a battleground for this conflict. Parenting forums have become places for both pro and anti-vaccine individuals to go to receive support as well as to refute the ideas of the other. The present research uses data collected from online vaccinations debate forums to find evidence of Coser's Theory and several social psychological phenomena including Social Identity Theory, confirmation bias, the Dunning-Kruger Effect, and collective hysteria. This research shows the transference of these theories into the online world and may be used in the future to find solutions to the current conflict.

International Adoption: Parent Perspectives

Samantha Hartman and Joy Hartman
Mentor: Dr. Deborah Sturtevant
Department of Sociology and Social Work

This project, "International Adoption: Parent Perspectives" is a follow-up of the Milk and Medicine Evaluation (2013). The Milk & Medicine Program is a supplemental feeding program for orphans and vulnerable children (OVC) in Lusaka, Zambia. An evaluation of the program in May 2013 included a trip to Zambia and provided insight into variables surrounding orphan care, systemic and governmental issues, and the depth of need for sustainable global development. The program evaluation exposed the need for continued research in the field of social work and OVC care, while equipping the research team, made up of two social work faculty and two undergraduate student research assistants, with excellent analytical and pragmatic research skills. The experience

working on the Milk and Medicine Project in Zambia combined with personal family international adoptive experience led to an interest in exploring the world of international adoption - one aspect on the vast spectrum of OVC care. We were specifically interested in the perspective of adoptive parents. Using a snowball method of sampling, twelve interviews were conducted with parents who have adopted internationally, representing seven countries. This exploratory study aimed to learn more about the perspective of adoptive parents concerning three categories that framed our thematic outcomes: pre-adoption, the adoption process, and post-adoption. Derived from Grounded Theory and an Open Coding process, results grouped around the three categories and nineteen micro themes, some of which included: motivation to adopt, resilience, grief and loss, attachment, and post-adoption support. Given the exploratory nature of the study and its interdisciplinary and complex nature, there is a large platform for future research.

"Remember, Unite, Renew": A Preliminary Situation Analysis of Nyamata, Rwanda

Anysie Ishimwe and Natalie Polanco
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Hope College has had a presence in the community of Nyamata, Bugesera, Rwanda (Nyamata) since 2008, and the student organization, BeHope Rwanda Project (*BeHope*), has been a significant point of connection between Hope College and Nyamata. This preliminary situation analysis was designed to provide the opportunity for members of Nyamata's community to have their voices heard with regard to future engagement with Hope College in order to support Hope's efforts to better align with community-identified needs, preferences, and practices. This project was a qualitative, exploratory investigation of Nyamata, Rwanda and the surrounding area**.** In this project, students from *BeHope* investigated community members' perspectives regarding Nyamata's strengths, needs, opportunities, trends, and resources, as well as the role of Hope College in their community. The research team used open and axial coding to identify key themes in members' responses. The organizing theme was identified as surviving vs. thriving over time: community/social factors that related to the idea of "surviving" were especially characteristic of the past-present, while "thriving" responses expressed desired/intended changes that are either presently occurring in an early stage or are hoped for at some point in the future. Suggestions for future engagement between Hope College and Nyamata, Rwanda include: expanding Hope College involvement in Rwanda (including conducting a full Situation Analysis); beginning to work more with the local government, as they have reliable information about the communities' needs and they know what is important and urgent; and continuing to increase the partnership circle by giving the Hope community opportunities to get involved (e.g. Rwanda May Term) and by getting involved in the community at-large outside of NCV.

The Effect of Mentoring Programs on the Self-Efficacy of Mentors and Mentees

Samantha Klokkert, Johanna Huss, and Mary Rose

Much of past research on mentoring programs focuses heavily on the benefits afforded to those being mentored—the mentees. However, we as researchers were interested to see what sort of effect a mentoring program would have on the mentors as well. The researchers developed and implemented a mentoring program utilizing college-aged mentors and female 6th and 7th grade mentees. The researchers hypothesized that the self-efficacy of both the mentors and mentees would significantly increase through participation in the mentoring program. Research was collected through a pre- and post-test of self-efficacy,

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prior to and at the conclusion of an eight-week group-mentoring program. Topics covered during the program include, but were not limited to: body image, self-esteem, boundaries, healthy relationships, and communication skills. The means of the self-efficacy rating were compared to determine if there was a significant increase in the self-efficacy of the mentors. Results will be presented as well as recommendations for future mentoring program development.

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Prevalence of Minorities in Special Education

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Minority groups are overrepresented in the United States' special education system. These erroneous placements are often due to language and cultural barriers and teacher expectations, not specific learning disabilities or other impairments. James S. Coleman was a sociological theorist who addressed the education system in terms of social capital and social networks, but did not explore special education. This paper provides a theoretical explanation for the imbalance of minority students in special education by expanding Coleman's original theories. Disengaged parents and teacher expectations are one aspect of this study. Parents facing inferiority in the education system may adopt passivity, perceived by educators as unwillingness to engage in the child's education. The social network within the special education system is also addressed to examine potential outcomes of fragmented networks. Interaction with each member of the social network does not guarantee a child's flourishing. Coleman's theory does not provide a comprehensive explanation of the challenges of minorities in the special education system, but I have expanded these ideas, applied them to the minority educational experience, and exposed some of the unmet needs of a population of vulnerable students.

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