Foreword from Dean Joe Dieker

Foreword from Dean R. Joseph Dieker:

Welcome to Cornell College's 22nd Annual Student Symposium!

The Student Symposium serves as a venue for some of our most engaged and accomplished students to share their work with the broader campus community and others. It demonstrates the remarkable range of interests pursued in and beyond the classroom at Cornell. This year features 72 students, working with 38 faculty members across 30 different departments and programs. There will be 34 oral presentations, 4 performances, and 34 poster presentations. The following pages present the schedule for the 2018 Student Symposium at Cornell College, along with the abstracts of the oral and poster presentations to be featured on this day.

In addition to recognizing student research, the organization of the Student Symposium also celebrates the liberal arts. Oral and poster presentations will cover a wide range of subjects, from Psychology to History. The Performing Arts will be showcased this year in multiple performances and presentations. At Cornell College, students draw meaning and gain a richer sense of knowledge through the connections made across disciplines and subjects. We are looking forward to celebrating this breadth of knowledge today by joining together for a Symposium lunch in Smith Dining Room. President Jonathan Brand and Lecturer in Statistics Brandi Shanata '05 will be our featured speakers.

This year's Student Symposium was coordinated by the Cole Library Center for Teaching and Learning. The logistics and technical aspects of the symposium were handled by Greg Cotton, Laura Farmer, Jennifer Ferrell, Amy Gullen, Jessica Johanningmeier, Kristin Reimann, Jen Rouse, Meghan Yamanishi, and Matt Zhorne. I offer my heartfelt thanks to them, and to the faculty members serving as session moderators, for their contributions to this project.

I invite you to participate in what promises to be a thought-provoking, exhilarating, and reflective day in our intellectual, creative, and community life.

R. Joseph Dieker, Dean of the College

SCHEDULE

Session One
9:00 - 10:15

AM Poster Session
10:00 - 11:30

Orange Carpet

Session Two
10:45 - 12:00

OVERVIEW

Lunch Session
Noon
Smith Dining Room

Remarks by President Jonathan Brand and Dean R. Joseph Dieker

Talk by Lecturer in Statistics Brandi Shanata ’05

PM Poster Session
1:00 - 2:30
Orange Carpet

Session Three
1:30 - 2:45

Oral & Performance Sessions

Session One 9:00am - 10:15am

Durham Room
Moderated by Marcela Ochoa-Shivapour, *en Español*

- **La Ceguera Durante la Época de Franco**
  Spanish
  Author: Amber Jerson
  Sponsor: Marcela Ochoa-Shivapour
- **How Characters Grow and Evolve: An Analysis of Natural Characteristics in Rivas' "La Lengua de las Mariposas"**
  Spanish
  Author: Rory Riordan
  Sponsor: Marcela Ochoa-Shivapour
- **La Lengua de las Mariposas**
  Spanish
  Author: Rubi Araiza Camba
  Sponsor: Marcela Ochoa-Shivapour

Hedges Conference Room
Moderated by Michelle Herder

- **Christine de Pizan's Authority in Writing *City of Ladies***
  Medieval & Early Modern Studies
  Author: Sara Renaud
  Sponsor: Michelle Herder
- **Eve: Reinterpreted**
  English & Creative Writing
  Author: Hannah Robertson
  Sponsor: Michelle Mouton
- **Defining Social Communities in Catullus**
  Classical Studies
  Author: Rachel Renaud
  Sponsor: John Gruber-Miller

Oral & Performance Sessions

OVERVIEW

Session One 9:00am - 10:15am

Russell Room

Moderated by Craig Teague

Studying the Effects of Perivascular Adipose Tissue on Notch Signaling in Human Vascular Smooth Muscle Cells

Biochemistry & Molecular Biology

Author: Caitlin Stieber

Sponsor: Craig Teague

Gas Separations Using Mixtures of Ionic Liquids for Potential Facilitated Transport of CO2 across a Membrane

Chemistry

Author: Rhowen Dalrymple

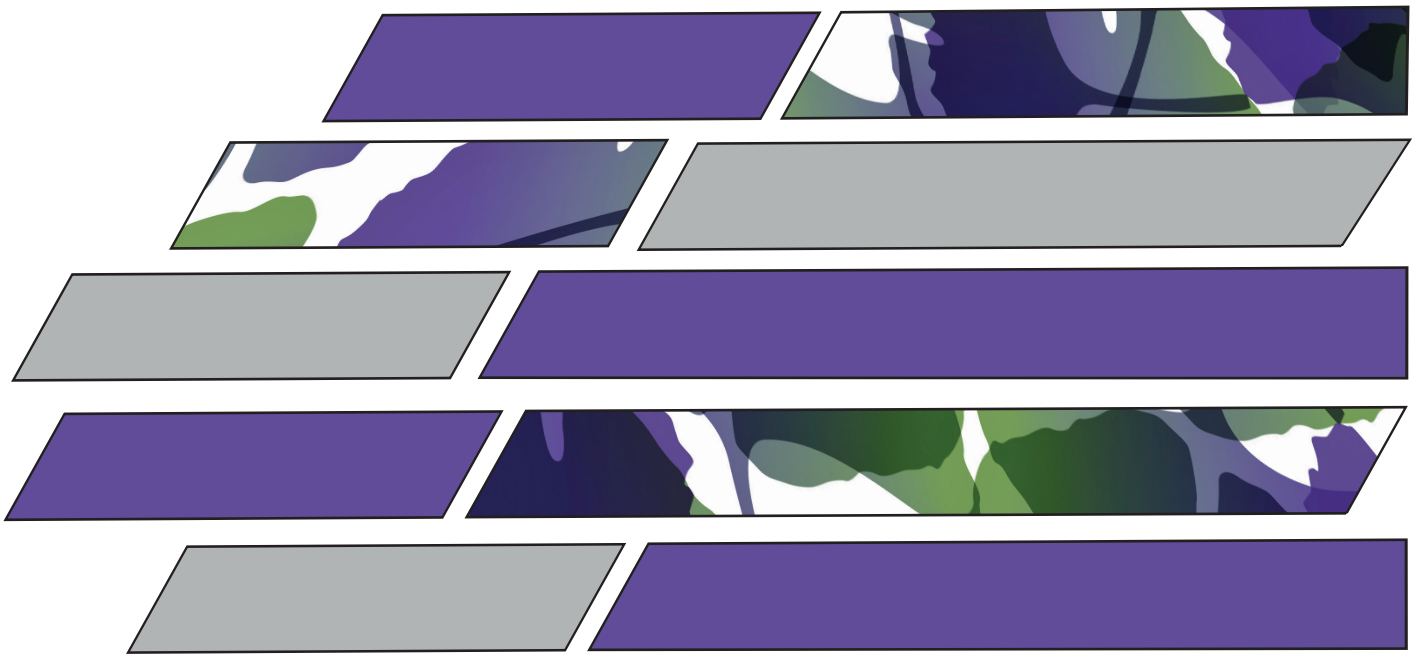
Sponsor: Craig Teague

Operation Walk: The Story of the Guatemalan People

Dimensions

Authors: Gabie Campbell, Renee Poulos

Sponsor: Mark Kendall



Oral & Performance Sessions

Session Two 10:45am - Noon

Hall-Perrine West
Moderated by Alvon Reed

- **Beauty in Amalgamation: A Study in Phantasmagoria in Visual Kei**
  Music
  Author: Samantha Frese
  Sponsor: James Martin
- **Minimalism: Pop Music for Intellectuals**
  Music
  Author: Cynthia Valenzuela
  Sponsor: Aaron Perrine
- **The Music and the Mirror**
  Dance
  Author: Cassie Gill
  Sponsor: Alvon Reed

Durham Room
Moderated by Devan Baty

- **Separating Church and State: Comparing "Freedom of Religion" in the United States and France**
  French
  Author: Madeline Blackburn
  Sponsor: Devan Baty
- ***Patrimoine* and the Commemoration of Slavery in Senegal**
  French
  Author: Maimouna Dia
  Sponsors: Devan Baty
- **EST Capstone: Interning at The Field Museum**
  Ethnic Studies
  Author: Jillian Schulte
  Sponsor: Misha Quill

Oral & Performance Sessions

Session Two 10:45am - Noon

Hedges Conference Room
Moderated by Christina Penn-Goetsch

Domenichino's *Contest of Diana and Her Nymphs*
Art & Art History
Author: Rachael Campbell
Sponsor: Christina Penn-Goetsch

A Forgotten Symbol of Florence: Donatello's *Penitent Mary Magdalene*
Art & Art History
Author: Brian Wyzgowski
Sponsor: Christina Penn-Goetsch

***Las Meninas de Falero*: A Narrative of Exile and Hope**
Art & Art History
Author: Steven Coburn
Sponsor: Christina Penn-Goetsch

Russell Room
Moderated by Amy Gullen

The Effect of the TRI-listed Carcinogenic Chemicals on the Incidence of Melanoma across the United States
Economics & Business
Author: Polina Durneva
Sponsor: Todd Knoop

Traveling as an Economist
Economics & Business
Author: Robert O'Hayre
Sponsor: Todd Knoop

Effect of a Dissonance-Based Eating Disorder Program on Cardiac and Psychological Risk Factors
Psychology
Authors: Elisabeth Sage, Abigail Cohen, Kendall Glennon, Kaitlyn Alvarez, Sandra Gomez, Gabby Carlson
Sponsor: Melinda Green

Oral & Performance Sessions

Session Three 1:30pm - 2:45pm

Hall-Perrine West
Moderated by Jai Shanata

- **Characterization of the Effect of 1-Octanol and Octanoic Acid on Model Gramicidin Ion Channels**
  Biochemistry & Molecular Biology
  Author: Jennifer Aguayo
  Sponsor: Jai Shanata
- **Systematic Characterization of Resveratrol in Planar Lipid Bilayers by Single-Molecule Studies**
  Biochemistry & Molecular Biology
  Author: Gabie Campbell
  Sponsor: Jai Shanata
- **The Production of an NMDA Receptor Via Recombinant Protein Expression for the Electrophysiological Analysis of its Activity When in the Presence of Donepezil and Memantine**
  Chemistry
  Author: Victor Martinez
  Sponsor: Jai Shanata

Hall-Perrine East
Moderated by Lynne Ikach

- **Translating Russian: A Student's Perspective**
  Russian
  Author: Brittany Wellman
  Sponsor: Lynne Ikach
- **Metaethics**
  Philosophy
  Author: Gus Turyn
  Sponsor: James White

Oral & Performance Sessions

OVERVIEW

Session Three 1:30pm - 2:45pm

Durham Room

Moderated by David Yamanishi

The Participatory Approach to Development: A Case Study of the Comprehensive Rural Health Project
International Relations
Author: Mara McLaughlin
Sponsor: David Yamanishi

The Role of National Stories in Creating the Conditions for Nationalist Genocide
Politics
Author: Shecharya Flatté
Sponsor: David Yamanishi

A Contemporary Look at Dependency Theory
Latin American Studies
Author: Lily Cott
Sponsor: Michael Mosier

Oral & Performance Sessions

Session Three 1:30pm - 2:45pm

Hedges Conference Room
Moderated by Caroline Price

- ***Our Stories*: A Showcase of Student Narratives**
  Theatre
  Author: Benjamin Kit Wong
  Sponsor: Caroline Price
- **Fiery Determination**
  Theatre
  Author: Kate Gielas
  Sponsor: Caroline Price
- **Neuro di Verse: Poetry for a Different Brain**
  Theatre
  Author: Christopher Ryerson
  Sponsor: Janeve West

Russell Room
Moderated by Rebecca Wines

- **Hillary Clinton and the Double-Bind: The 2016 Election**
  Gender, Sexuality, & Women's Studies
  Author: Kate Brogan
  Sponsor: Christina Penn-Goetsch
- **Molly Bloom's Moment: An Examination of Molly's Representation in Film**
  English & Creative Writing
  Author: Margaret Byrne
  Sponsor: Kirilka Stavreva
- **How Far Does the Apple Fall from the Tree?: The Construction and Transmission of Gender Ideologies in a Cross-generational Case Study of an American Family**
  Gender, Sexuality, & Women's Studies
  Author: Madeline Blackburn
  Sponsor: Rebecca Wines

Oral & Performance Sessions

OVERVIEW

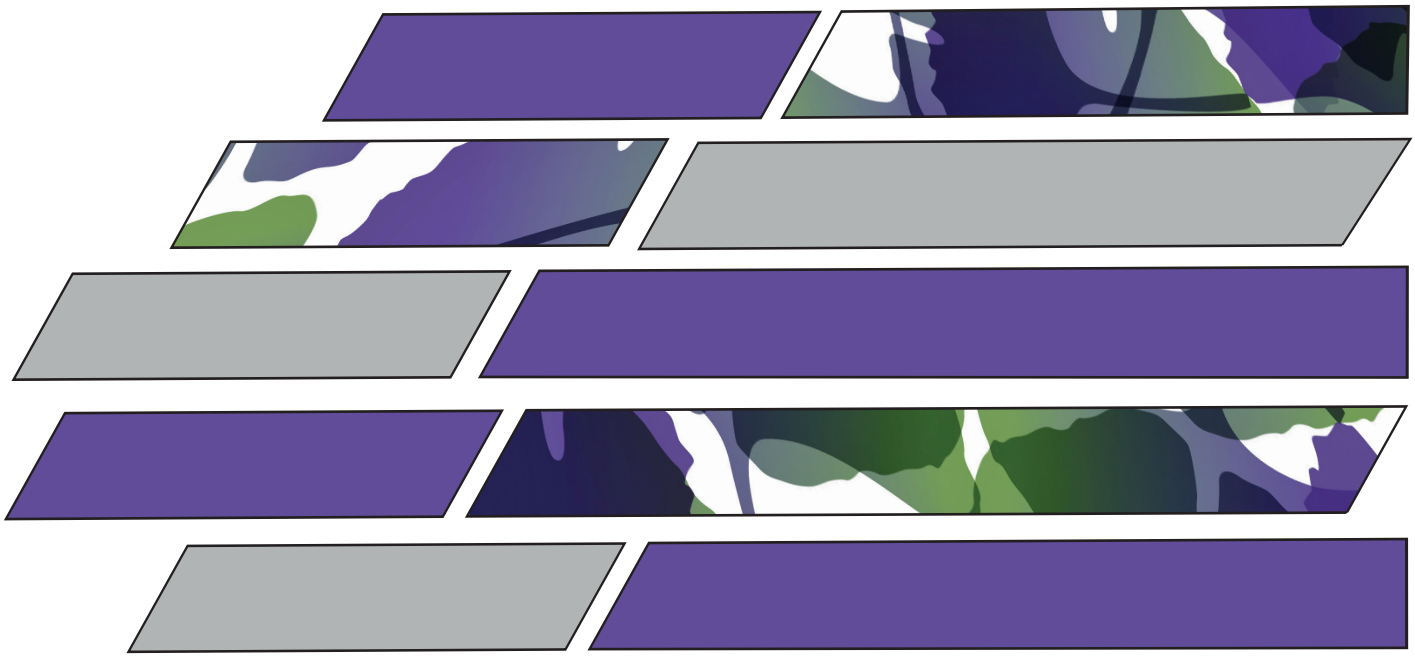
Session Three 1:30pm - 2:45pm

Martin Luther King Jr Room
Moderated by Tammy Mildenstein

Mowing versus Non-Mowing in Eight Iowa Prairies
Environmental Studies
Author: Marin Dettweiler
Sponsor: Tammy Mildenstein

The Effect of Pond Size on the Health of Bluegill
Biology
Author: Gage Griffin
Sponsor: Tammy Mildenstein

Analytical Exploration of Dimerization and Aggregation in Methylene Blue
Chemistry
Author: Huong Quynh Anh Nguyen
Sponsor: Charles Liberko



Poster Symposium Sessions

Morning Session 10:00am - 11:30am

1a **Aging in Sport: A Preliminary Exploration of Defeatist Language in Print Media**
Kinesiology
Author: Sierra Caldwell
Sponsor: Christina Johnson

2a **Vascular Correlates of Depression**
Biochemistry & Molecular Biology
Author: Jennifer Davis
Sponsor: Craig Tepper

3a **Milkweed Numbers as a Limiting Factor to Monarch Populations in Tallgrass Prairies of Midwest, USA**
Environmental Studies
Authors: Marin Dettweiler, Camden Grundeman
Sponsor: Tammy Mildenstein

4a **Manipulation of Bacteriophage**
Biochemistry & Molecular Biology
Author: Marisa Flores
Sponsor: Jeffrey Cardon

5a **Cellular Stress and Senescence as a Pertinent Factor in in vitro Merkel Cell Polyomavirus Replication**
Biology
Author: Sabine Hahn
Sponsor: Barbara Christie-Pope

6a **Republication of Winifred Mayne Van Etten**
English & Creative Writing
Authors: Jessica Halter, Emma Meyer, Maureen Sullivan
Sponsor: Leslie Hankins

7a **Extraction of Metal Ions from Water Using Lignin Isolated from Sawdust**
Chemistry
Author: Katherine Heidt
Sponsor: Charles Liberko

8a **Catalysis Incorporated: Innovative Healthcare for the Future**
Psychology
Author: Oriana Henney
Sponsor: Melinda Green

9a **Measuring the Sun's Radio Temperature**
Physics & Engineering
Author: Marshall Hobson-Ritz
Sponsor: Derin Sherman

10a **Wireless Power Transmission from Evanescent Waves**
Physics & Engineering
Author: Cole Horan
Sponsor: Derin Sherman

Poster Symposium Sessions

Morning Session 10:00am - 11:30am

Kinesthetic Classrooms: A Review **11a**
Kinesiology
Author: Nina Kahn
Sponsor: Kristin Meyer

Can Coral Beat the Heat? **12a**
Biology
Author: Amanda Leimbach
Sponsor: Craig Tepper

X-Ray Fluorescence and Inductively Coupled Plasma Spectroscopy Analysis of Huston-Fox Pottery **13a**
Chemistry
Author: Samantha Nadel
Sponsor: Cynthia Strong

Sports: Women vs. Media **14a**
Kinesiology
Author: Quinn Quintana
Sponsor: Kristin Meyer

Instrumental Records of Modern Flooding Events at Cave KNI-51, Australian Tropics **15a**
Geology and Environmental Studies
Author: Shay Rule
Sponsor: Rhawn Denniston

Symbiosis in Marine Gastropods: What are Photosynthetic Symbionts Doing in Shell-bearing Snails? **16a**
Biochemistry & Molecular Biology
Authors: Mary Tamo, Libby Anderson
Sponsor: Craig Tepper

Comparing Trace Element Ratios with Isotope Ratios in Tropical Australian Stalagmites **17a**
Environmental Studies
Authors: Stephanie Voller, Cali Pfleger
Sponsor: Rhawn Denniston

Core Strength and Frontal Plane Projection Angle in Relation to Incidence of Injury **18a**
Kinesiology
Authors: Stephanie Xavier , Melissa Orton
Sponsor: Kristin Meyer

Influence of the Samalas Volcanic Eruption of 1257 on Equatorial Monsoon Patterns in Northern Australia **19a**
Geology
Author: Cole Zrinsky
Sponsor: Rhawn Denniston

Poster Symposium Sessions SCHEDULE

Afternoon Session 1:00pm - 2:30pm

1b Evidence of Cognitive Dysfunction Following Two Weeks of Soccer Heading
Biochemistry & Molecular Biology
Author: David Berger, Lucas Casten, Jason Patiño
Sponsor: Steven Neese

2b Creation of a Hip Fracture Surgical Simulator
Physics & Engineering
Author: Nicholas Bieno
Sponsor: Brian Johns

3b Controlling Pore Width of Ordered Mesoporous Carbons with Polyethylene Glycol
Chemistry
Author: Jesse Coppess
Sponsor: Craig Teague

4b What You Can Learn in Rehab: Notes from an Internship with a Wildlife Rehabilitation Center
Biology
Author: Julia Eastham
Sponsor: Tammy Mildenstein

5b Life as a Russian Orphan
Russian
Author: Kimberly Gordon
Sponsor: Lynne Ikach

6b Modeling the Shape of the Rosette Nebula
Physics & Engineering
Author: Marshall Hobson-Ritz
Sponsor: Kara Beauchamp

7b Vesicles, Dopamine Neurotoxicity, and Parkinson's Disease
Biochemistry & Molecular Biology
Author: Nina Kahn
Sponsor: Barbara Christie-Pope

8b Modeling Archery Performance
Mathematics & Statistics
Author: Kasper Kittredge
Sponsor: Tyler Skorczewski

9b Various Methods of Experimentally Measuring the Radius of Atoms: The Ramsauer-Townsend Effect and Electron Diffraction
Physics & Engineering
Author: Jay Marshall
Sponsor: Derin Sherman

Poster Symposium Sessions

Afternoon Session 1:00pm - 2:30pm

Still in the Game: The Influence of Competence, Relatedness, and Autonomy on Vitality among Older Adults **10b**
Kinesiology
Author: Neil Pagdin, Thomas Greene
Sponsor: Christina Johnson

Stable Isotopic and Environmental Responses to Climate Variability in Three Northwest Australian Caves **11b**
Environmental Studies
Author: Danielle Polson
Sponsor: Rhawn Denniston

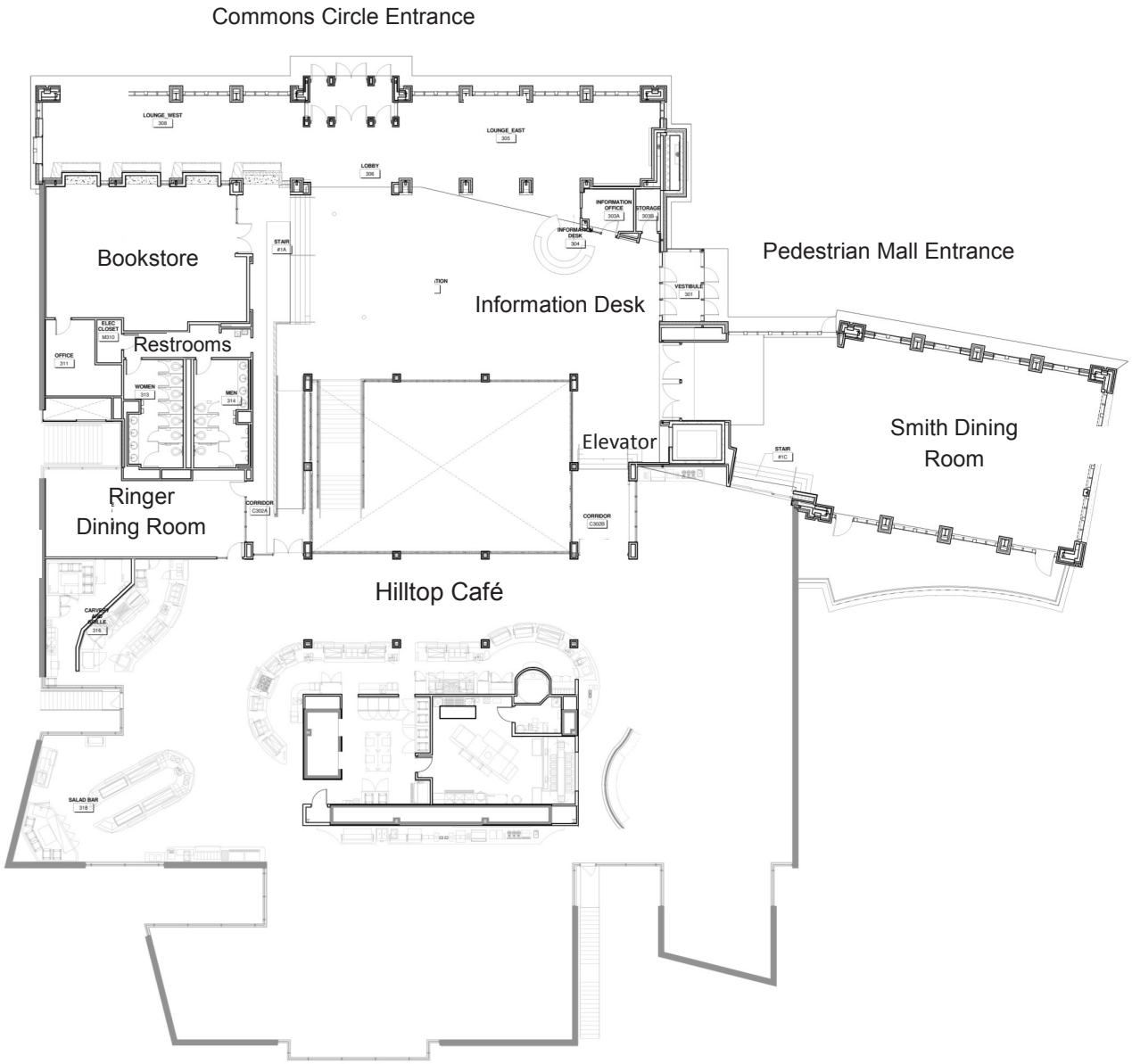
Extracting, Amplifying, and Sequencing Pteropodidae DNA from Excrement Samples **12b**
Biochemistry & Molecular Biology
Author: Rebecca Ritter
Sponsor: Tammy Mildenstein

The Development, Application, and Impacts of Person-Directed Care **13b**
Kinesiology and Anthropology
Author: Jillian Schulte
Sponsor: Christina Johnson

Ionic Liquid Membranes and Adsorbents Derived from Carbonated Beverages for Gas Separations **14b**
Chemistry
Author: Caitlin Stieber
Sponsor: Craig Teague

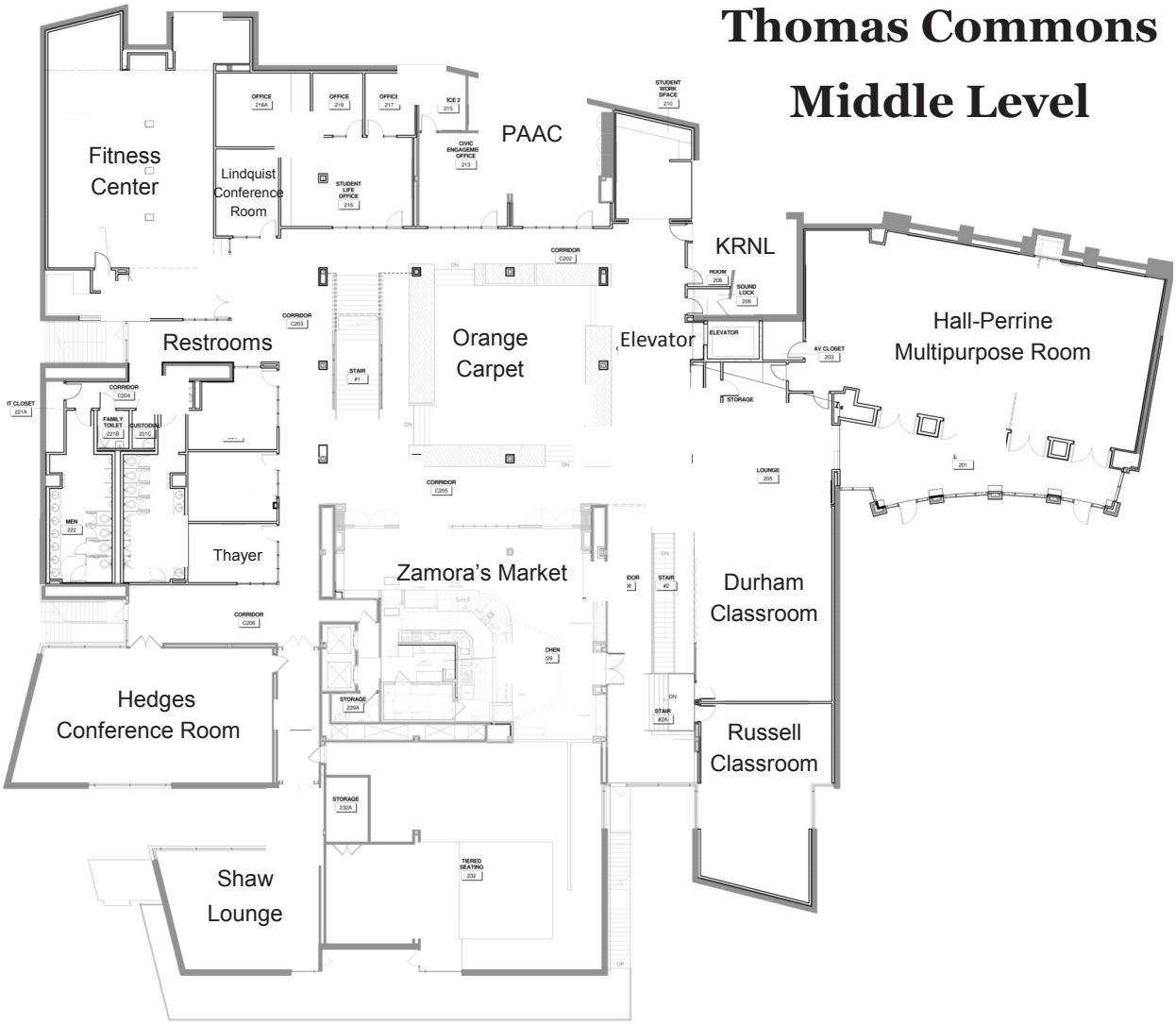
Reconstruction of the P-T Path of Metapelites in the Harcuvar Core Complex, NW Arizona **15b**
Geology
Author: Carlos Tellez
Sponsor: Emily Walsh

Thomas Commons
Upper Level



The Thomas Commons

Thomas Commons Middle Level



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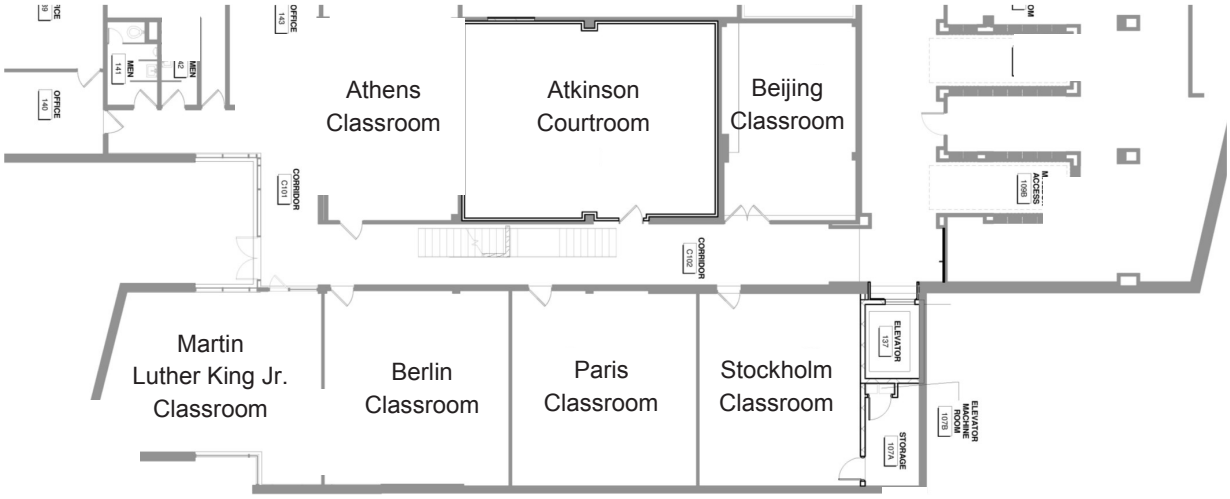

ABSTRACTS

Jennifer Aguayo, '18 **Chicago, IL**
Biochemistry & Molecular Biology *Jai Shanata*

Characterization of the Effect of 1-Octanol and Octanoic Acid on Model Gramicidin Ion Channels

Although often neglected during drug effect studies, direct drug interactions with the cell membrane offer valuable insight into a potential mechanism of drug effects. Prior research has proposed that 1-octanol and octanoic acid diminish tremor intensity in patients with Essential Tremor, a neurological disorder that causes tremors of various limbs. Through the use of model planar lipid bilayers, incorporation of gramicidin A ion channels, and various drug concentrations, this research attempts to quantitatively and qualitatively determine the impact of specific drugs on the physical properties, hence function as well, of cell membranes. These electrophysiology experiments are performed by applying voltage to cell membranes in the absence (control) and presence of 1-octanol (10 nM) or octanoic acid (10 nM &100 nM). Subsequently, current will flow through a dimerized conformation, and previously incorporated, of gramicidin A ion channels. Conversely, no current flow will be measurable if gramicidin is in an un-dimerized conformation. The incorporation of the drug by the cell membrane can potentially cause a change in its physical properties; consequently, causing a shift in the dimerized and un-dimerized equilibrium of gramicidin A ion channels. Ultimately, this measurable change in equilibrium can indicate a potential mechanism by which these drugs cause their favorable effects. An additional project of this research includes an investigation on resveratrol, a naturally occurring polyphenol found in red wine, which is hypothesized to have life-extending capabilities. As1-octanol is a common food additive, further research hopes to focus on diet and its effects on cell membrane; more specifically, polyunsaturated fatty acids (PUFA), which include some essential fatty acids.

Rubi Araiza Camba, '20 **Basalt, CO**
Spanish *Marcela Ochoa-Shivapour*

La Lengua de las Mariposas (*en Español*)

Religion's role in education has been a great source of debate throughout history. Although society today has veered away from the imposition of religion by the state, there was a time where religion was the basis of everyday life. Denying the existence of God was a crime worthy of death, particularly in Hispanic Catholic countries where religion played a prominent role in the shaping of customs, traditions, and beliefs.

This presentation uses the Spanish reading of *La Lengua de las Mariposas*, by Manuel Rivas, to analyze the role of Spain's education system during the rule of Francisco Franco. Franco was a military dictator in the 1930s, a time famous for progression and scientific discoveries. However, during this time period, Franco, along with many others, opposed the concept of scientific advancement. Religion was the primary focus, and by turning to science, people would turn away from God. With this in mind, we will follow the timeline of a young boy (Gorrion) and his mentor (Don Gregorio) on their search for knowledge in a time of terror and religious assertion. Through societal pressure and fear, the Spanish government restricted the advancement of education. This is depicted clearly in society's treatment of Don Gregorio. Being a well-read man, Don Gregorio is shunned by society and eventually arrested by the state police for his influence toward science rather than religion. In this way, the author clearly states his view on how Spain deprived students of their right to learn. *La Lengua de las Mariposas* goes on further to highlight how General Franco used his authority in conjunction with the Catholic church to prohibit science in schools with the use of symbolism and religious figures.

David Berger, '19 **Tualatin, OR**
Lucas Casten, '18 **Folsom, CA**
Jason Patiño, '18
Biochemistry & Molecular Biology *Steven Neese*

Evidence of Cognitive Dysfunction Following Two Weeks of Soccer Heading

Concussive brain injury may produce cognitive dysfunction in athletes from sports with high incidence of head impacts (Giza & Hovda, 2014). Soccer currently shows a lower incidence of concussion than other contact sports (Pfister et al., 2016). Interestingly, research suggests that soccer "heading" may result in subconcussive brain injury and correlate with deficits in athlete performance on tasks of executive function when testing occurs both immediately (i.e. after practice) or after one year of play (Lipton et al., 2013; Stewart et al., 2017). Few studies have attempted to determine the short-term cognitive effects of soccer heading using a pre- and posttest design. The purpose of this study was to determine the short-term relationship between soccer heading over a 2-week period and performance on a battery of tasks of executive function.

Eight male soccer players were tested on 10 dual-task interference tests of executive function, where cognitive function and postural control must be simultaneously processed and attention must be divided, allowing for a more sensitive measure of cognitive dysfunction (Iverson, Kaarto, & Koehle, 2008). The balance error scoring system (BESS), a test of static balance involving three different stances (double, single leg, and tandem), was completed twice, initially on a firm surface and subsequently on a foam balance pad (Iverson, Kaarto, & Koehle, 2008). Simultaneously, each participant completed a cognitive test that tapped working memory or reaction time (Teel et al., 2013). Two weeks later, heading count was self-reported (Catenaccio et al., 2016), and these players underwent post-testing of the dual-task battery. Eight nonathletes served as controls.

Soccer players showed a reduction in immediate word recall during post-testing as compared to control participants, $F(1, 14) = 4.20$, $p = 0.03$. In addition, the number of soccer headers over a 2-week period was negatively correlated with the performance of an alphabet backwards task, $r(7) = -0.75$, $p = 0.016$, and positively correlated with an increased time to complete an automated task of reaction time, $r(7) = 0.693$, $p = 0.028$.

Overall, these results suggest that subconcussive head impacts result in short term reductions in the performance of tasks of working memory during dual-task testing. Reaction time was also increased, suggestive of a more general effect of soccer heading on executive function. Questions about whether head impacts in soccer have meaningful long-term consequences should be explored.

Nicholas Bieno, '18
Physics & Engineering

Oregon, WI
Brian Johns

Creation of a Hip Fracture Surgical Simulator

By 2040, incidence rates of hip fractures are expected to reach 500,000 annually in the US. Institutions across the country will need to educate surgical residents on how to properly deal with the influx of new hip fracture cases before that time. The current educational programs for surgical residents are costly in both time and money. Equally worrying are the methods currently used for teaching and practice of surgical residents. These methods often require real human patients in addition to using actual X-ray imaging and a full staff of professionals in the operating theater to assist the surgical resident. Even after learning through these methods, it has also been found that when surgical complications arise, 93% are caused by errors in technique or judgement. For these reasons, over the summer of 2017, design and fabrication began on an educational surgical simulator that hopes to change the way surgical residents are taught. Using cutting-edge virtual reality displays and real world physical models, the simulator gives the visuals of a true operating theater while maintaining the physical aspects of performing the surgery. Instead of relying on cadavers or volunteer patients, this educational simulator will allow surgical residents to practice on simulated bones instead. Additionally, the simulator does not require the use of X-rays, nor the extra expenses that incur from employing a room full of professionals in a traditional operating theater. Combining elements from engineering, computer science, medical fields, digital modeling, and animation, this project incorporates multiple disciplines into a future method of surgical resident education.

Madeline Blackburn, '18
French

Itasca, IL
Devan Baty

Separating Church and State: Comparing "Freedom of Religion" in the United States and France

Formally established by the 1905 Law on the Separation of Churches and States, the French principle of laïcité is a central component of French society and identity. Laïcité is generally translated as "secularism;" however, the English term cannot not fully convey the significance of laïcité in French society. A better explanation of laïcité is that it intends to protect "[the] freedom of conscience and religion; the equality of different religions; and the neutrality of the state and religious institutions in their respective spheres of activity" (Massignon, 2011).

Across the ocean in the United States, the term "religious freedom" has very different implications. As a country founded by European settlers seeking the freedom to practice their religion, "the United States prioritizes religious freedom over public neutrality toward religion by giving more protection to religious than to secular beliefs" (Kutoroff, 2015). In fact, the First Amendment to the Constitution of the United States includes the protection of religious freedoms with the Establishment and Free Exercise Clauses, which read "Congress shall make no law respecting an establishment of religion, or prohibiting the free exercise thereof…"

These laws are examples of the values and cultures that have developed in each country as a result of their unique histories. This presentation will compare and contrast French and American conceptions of "religious freedom," beginning with a brief overview of the relevant historical contexts for each country, followed by a comparison of relevant legislation and judicial bodies. Finally, French and American examples of discrimination against others, as well as controversies that have their basis in religion, will be compared.

Madeline Blackburn, '18 **Itasca, IL**
Gender, Sexuality, & Women's Studies *Rebecca Wines*

How Far Does the Apple Fall from the Tree?: The Construction and Transmission of Gender Ideologies in a Cross-Generational Case Study of an American Family

An individual's gender ideology is the sum of their opinions concerning the roles, rights, and responsibilities of men and women in society. For example, those who hold certain gender ideologies believe that the particular roles assigned to men and women as breadwinner and homemaker, respectively, are important and necessary for the prosperity and stability of society and the individual. The development of an individual's gender ideology is influenced by myriad variables such as biological sex, generational cohort, religious affiliation, culture, and educational experience. Taking these and other variables into account, this project seeks to explore the construction and transmission of gender ideologies on a micro-level through the institution of family by conducting a case study of two branches of the same family.

I decided to interview members of my family for several reasons. I have access to extended family members and these previously established relationships already come with some level of trust. Furthermore, by focusing on my family, I have previous knowledge of important contextual history, historical documents, and other intimate resources which would not necessarily be readily accessible to an outside researcher. In addition to these practical reasons, my family makes an interesting case study because of the historical circumstances that have led to the current familial composition.

The different histories of families have profound effects on the development and cross-generational transfer of gender ideology on the individuals. By looking at this aspect of gender ideology at a micro-level, I hope to advance the current understanding of the processes by which gender ideology is individually constructed and transmitted from generation to generation.

Kate Brogan, '18 **St. Paul, MN**
Gender, Sexuality, & Women's Studies *Christina Penn-Goetsch*

Hillary Clinton and the Double-Bind: The 2016 Election

In the political sphere, women have a very different experience than men. This - to many - is obvious, especially in today's political climate. What many people do not realize is that the challenges that women face in politics are rooted in the systematic oppression of women that affect their everyday lives in both the private and public sphere. This was certainly apparent in the 2016 elections. Hillary Clinton addressed these challenges in an interview from 2017, when she discussed the double-binds that women face. The double-bind was first addressed by Gregory Bateson who defined the double-bind as "an emotionally distressing situation in which an individual (or group) receives two or more conflicting messages … so that the person will automatically be wrong regardless of their response." For my interdisciplinary gender studies capstone, I developed a video that combines Hillary Clinton's commentary and the unrealistic expectations that were projected onto her throughout the 2016 campaign.

In Carrie Mae Weems' video, *The Obama Project*, from 2012, Weems projected images onto a bust of Barack Obama in a non-stop replay of the images to the score of Samuel Barber's "Adagio for Strings." The video features Obama's image with a number of historical individuals and characters from popular culture projected on an almost blank canvas accompanied by monologue by Carrie Mae Weems.

By taking this same concept of *The Obama Project* and applying it to the 2016 election with Hillary Clinton, I am examining the ways in which unrealistic views were projected onto Hillary Clinton as a female candidate. These images will be combined with Clinton's own commentary on the double-binds women face. In this manner, I hope to make the political challenges that women face more accessible to a broad audience of people inside and outside the academic and political worlds.

Margaret Byrne, '18
English & Creative Writing

La Grange, IL
Kirilka Stavreva

Molly Bloom's Moment: An Examination of Molly's Representation in Film

There has been a large amount of literary scholarship on James Joyce's *Ulysses* in general and on the final chapter of the novel, in particular. In this chapter, known as the "Penelope Chapter" or "Molly's Soliloquy," the writing enters the character Molly Bloom's stream of consciousness as she lays awake in her bed thinking about her day, her life, her relationships, and much else. This style of writing has been categorized as an example of the écriture féminine, a concept within French feminist theory first used by Hélène Cixous and developed by Luce Irigaray and Julia Kristeva, that literally translates into "women's writing." Écriture féminine refers to a style of writing that mimics feminine experience, especially the female experience of the body. "Molly's Soliloquy" delves into Molly's feminine experience with a focus on Molly's perceptions about her own body in a style that disregards traditional conventions of syntax and grammar.

The chapter of "Molly's Soliloquy" has provided a unique challenge for filmmakers. How does one visually interpret such non-traditional writing and capture the intention that underlies the decision to depart from convention? This paper examines its interpretation within Joseph Strick's 1967 adaptation of *Ulysses*. Specifically, this project examines in what ways Strick's interpretation of the chapter aligns with the concept of écriture féminine laid out in French feminist theory. The project will first discuss briefly French feminist poststructural theory using the writings of Hélène Cixous, Luce Irigaray, and Julia Kristeva as sources. Then, the project will take a close look at the scene within the 1967 film and compare the visual interpretation to the theory previously discussed.

Sierra Caldwell, '19
Kinesiology

Carbondale, CO
Christina Johnson

Aging in Sport: A Preliminary Exploration of Defeatist Language in Print Media

Ageism is exceedingly prevalent within society today, especially within the realm of athletics. The purpose of this preliminary research is twofold: 1) to explore the current information available to older adults surrounding the central theme of physical activity and 2) to identify if defeatist language within popular media exists. There is currently no research of the defeatist culture within mass media relating to physical activity available to the aging population. The current study is a preliminary, critical analysis (e.g., Coakley & Dunning, 2000; Pringle & Markula, 2005) of mass media sources intended to explore the viability of a larger project examining the positioning of aging adults within health and fitness media. In this project, we explore the construction of cultural narratives of "aging-as-disability" and the extent to which media sources participate in the use of defeatist language surrounding older adults' health and physical activity. Our findings contribute to a deeper understanding of the culture of physical activity within the aging population which effects health individually, locally, and globally.

Gabie Campbell, '18 **Livingston, WI**
Biochemistry & Molecular Biology *Jai Shanata*

Systematic Characterization of Resveratrol in Planar Lipid Bilayers by Single-Molecule Studies

In scientific research, data analysis is just as important as data collection, especially when working on an electrophysiology rig. Over the past few years, the Shanata lab has collected data without doing much data analysis. Data is collected by measuring changes in current across the membrane so that the effect of resveratrol at different concentrations can be determined, resulting in a large, nearly-unreadable file showing the current across a membrane over time that must be systematically worked through to unlock the information it holds. This past semester, I worked to analyze some of the data collected over summer 2017 CSRI.

The parameters of data analysis have a large effect on the results. Initial data analysis has shown that resveratrol affects bilayer properties, seen through longer ion channel dimerization as resveratrol concentration increases. However, by investigating the effect of analysis parameters on data analysis, a systematic way to analyze data can be determined.

Gabie Campbell, '18 **Livingston, WI**
Renee Poulos, '18 **Arlington Heights, IL**
Dimensions *Mark Kendall*

Operation Walk: The Story of the Guatemalan People

Operation Walk is a non-profit organization that was founded in 1994 by Dr. Lawrence Dorr, a Cornell College graduate of 1963. Operation Walk provides free knee and hip surgeries to patients around the world. Operation Walk is comprised of 17 teams, has completed over 100 trips in 20 different countries, and has served nearly 10,000 patients. The Operation Walk team is composed of passionate volunteers that include students, orthopedic surgeons, physical therapists, nurses, and many other healthcare professionals who work together to provide preoperative care, surgeries, and postoperative care for people suffering from arthritis, polio, or other knee and hip complications.

This past August, we embarked on a journey to Antigua, Guatemala. During our mission, patients from all over Guatemala received knee replacements for nearly no cost and shared the inspiring stories of their lives.

As students, we had many "hands-on" experiences including helping with patient transport, aiding with physical therapy exercises, scrubbing in to observe surgeries, helping nurses with bandages or medications, and performing numerous other tasks that required our assistance. We worked side-by-side with many skilled physicians and had the opportunity to interact with many amazing patients and their families. This was a transformative experience for us, but seeing what the patients get from this experience is the most rewarding feeling of all. In the words of Dr. Dorr, "You don't get many opportunities in life to give something to someone that gives them a whole new life." This experience was life-changing and has reinforced our motivation to pursue healthcare.

Rachael Campbell, '18
Art & Art History

Colorado Springs, CO
Christina Penn-Goetsch

Domenichino's *Contest of Diana and Her Nymphs*

Domenichino's *Contest of Diana and Her Nymphs* (1616) is a subtle, yet wholly beguiling, work in which an archery contest between the Goddess Diana and her rather alluring nymphs is portrayed. When faced head-on with the image, one is presented with a scene that is rich in color, movement, and sensuality. In the center of the work stands the towering Diana, her arms triumphantly raised above her head, hands holding her bow, quiver, and hunting horn. She is surrounded by a rather astounding number of nymphs. Their arrows fly across the picture plane, aimed at a bird which is tied to the top of a pole. From here, the eyes are drawn to the right, just in front of Diana, where there is a dramatic outburst of movement as a nymph restrains a lunging dog that directs us toward the voyeurs hidden stealthily behind the bushes. What is most fascinating, however, is the nymph directly in front of Diana. She faces out toward the viewer, her body erotically placed on display. Yet her eyes are the main focal point, as they challengingly snare the viewer as if he or she were game.

This large oil painting hangs in Rome's Villa Borghese, as a part of the collection of Cardinal Scipione Borghese. Yet such a subject for a cardinal seems rather unexpected, especially due to its erotic tensions. Most recent scholarship concerns the identification of the subject matter. Julian-Matthias Kliemann has argued that this image is the product of a discussion on poetry about Virgil's *Aeneid*. Kristina Herrmann Fiore saw the rhetorical message as a representation of the triumph of chastity. Yet what these scholars have not addressed is that the painting was commissioned by another cardinal, Cardinal Pietro Aldobrandini, as an additional work for a completely different collection of earlier paintings. The *Contest of Diana* was originally intended to accompany Titian's *Ariadne and Bacchus,* as well as Titian's *Bacchanal of the Andrians* and *Worship of Venus*. Although much earlier in date, this series of works provides a key to understanding the appeal of Domenichino's painting of the huntress to Aldobrandini, as well as its later appeal to Borghese. This information, coupled with a closer examination of various elements of the work itself, expresses the morals of Renaissance and Baroque Italy and encourages the further ever-changing representation of the woman as a dangerous seductress.

Steven Coburn, '18
Art & Art History

Naples, FL
Christina Penn-Goetsch

Las Meninas de Falero: A Narrative of Exile and Hope

Emilio Falero's 1977 painting *Las Meninas Industriales* prominently features an image of the young princess Margarita Teresa and two of her maidservants, torn from Diego Velazquez's *Las Meninas* (1656). They stand in front of a wall of large modern glass windows through which we see a harsh and lifeless industrial landscape. Certain details on the figures have been altered and a slight difference in style becomes apparent. This painting is a reflection of the life of an artist forced to flee his homeland as a refugee, completely unaccompanied but guided and protected all the while by his unwavering religious faith. The removal of Velazquez's *meninas* from their original context and the alteration of the appropriated images within a fantasy world of Falero's own creation reveals a narrative of forced separation, longing, and ultimately assurance, protection, and hope.

Lynette Bosch discusses Falero's art in *Cuban-American Art in Miami: Exile, Identity, and the Neo-Baroque* (2004), but neither she nor any other scholar has fully analyzed how Falero's art addresses exile. In general, as of yet, very moderate attention has been paid to Falero's work from the scholarly community, and no detailed inspection of *Las Meninas Industriales* exists. Exhibition catalogues and newspaper articles only mention this oil painting in the context of Falero's unique artistic language, in which he juxtaposes contrasting quotations from the work from the Western canon. I will build on this approach by providing a formal and an iconographical analysis of *Las Meninas Industriales* as compared to Velazquez's *Las Meninas*. But this will only provide a partial picture. An examination of those who experienced the Cuban revolution of 1959 as children and subsequently fled from Cuba will be necessary in order to demonstrate how Falero uses his visual language to express his personal experience as a Cuban-American exile.

Jesse Coppess, '18 **Pennfield, MI**
Chemistry *Craig Teague*

Controlling Pore Width of Ordered Mesoporous Carbons with Polyethylene Glycol

Additional Authors: Craig M. Teague, Jennifer A. Schott, Richard Mayes, Sheng Dai, Shannon M. Mahurin

Whether it's climate change, the energy crisis, or any other environmental concern, the public tends to look to scientists for an answer. Many of today's issues can be countered through developments in materials chemistry. For instance, ordered carbon materials are sought after for gas separation, catalysis, and conductivity research. Most recently, mesoporous carbon materials have been a focus in gas separation experiments. The synthesis of ordered carbon materials generally utilizes either a hard template, such as silica or a soft template from a polymer. If we can more reliably control the pore width of soft-templated carbons through a similar overall reaction, then we can further optimize these materials for gas separation research. We synthesized soft-templated, ordered mesoporous carbons (OMCs) using varying reagent concentrations to observe their effect on pore width distribution. We observed and analyzed the relationships among the core reagents of our synthesis: polyethylene glycol (PEG), pluronic F127, and resorcinol. We compared data obtained from synthesized experimental materials with varied concentrations to baseline OMCs. We predicted that varying the concentrations of resorcinol, pluronic F127, and PEG would shift the pore size distribution maxima in a predictable pattern while maintaining the overall ordered structure and high surface area. Our results suggest that an increased PEG concentration in relation to resorcinol decreases the pore width maxima, without significantly decreasing the material's surface area and pore volume. Our results also suggest a miniscule shift in pore width among samples with varied F127 concentrations, as well as for samples that had a simple addition of PEG. The patterns observed during the analysis of our samples will provide a route for further research into the optimization of ordered mesoporous carbons for gas separation.

Lily Cott, '18 **Chicago, IL**
Latin American Studies *Michael Mosier*

A Contemporary Look at Dependency Theory

In the field of Latin American Studies, Dependency Theory has been one of the most dominant ideas since its inception. Dependency Theory can be explained as economic activity in rich countries (such as the United States) resulting in serious economic problems in poorer countries (such as Latin America). Dependency is the root of widespread poverty and inequality in all of Latin America and is more important than ever today. The United States buys raw materials from Latin America at abusively low prices and later sells the finished products back to Latin America at extremely high prices, therefore keeping Latin America dependent on exporting to the United States in order to afford the cost of their necessary imports. The United States continues to profit off of Latin America while Latin America struggles to survive, and this has been occurring in a continuous cycle for decades. Many authors and theorists have proposed policy change to address this problem, but I have found through my research that this problem cannot be solved from the top down, and rather needs to be solved from the bottom up. Throughout this project, I take a new look at Dependency Theory and propose that the action of grassroots movements and organizations would be much more effective than policy change in freeing Latin America from Dependency. I will also explore Dependency Theory as a dialectic, instead of as an exclusively internal or external problem, as many theorists have taken a firm stance on either side.

Rhowen Dalrymple, '18
Chemistry

Fort Collins, CO
Craig Teague

Gas Separations Using Mixtures of Ionic Liquids for Potential Facilitated Transport of CO2 across a Membrane

Additional Authors: Sheng Dai, Craig Teague, Shannon M. Mahurin

Global Warming is a threat to the continued existence of mankind. Global Warming is caused by emissions of various gases that create a greenhouse gas effect. Gas separations provide a simple way to reduce these gas emissions without limiting production. Ionic liquids, nonvolatile molten salts, are garnering interest for various energy applications. A critical application is gas separations, such as the separation of CO2 from other gases. Membranes are often used in conjunction with ionic liquids for experimental support and stability. While most membranes follow the solution/diffusion mechanism, facilitated transport offers a way to improve permeability and selectivity. Facilitated transport occurs when CO2 binds to the anion of an ionic liquid and is carried across the membrane faster than by diffusion. Higher gas permeabilities and selectivities can occur through facilitated transport compared to simple diffusion due to a trade off as indicated by the Robeson upper bound. In particular, selectivity in facilitated transport will increase at lower transmembrane pressure leading to increased separation efficiency. We tested the gas separation properties of the ionic liquids [P66614] [Tf2N] and [P66614] [triazole] by combining various mixtures of both anions from 5% to 20% triazole. We incorporated the ionic liquid mixture into a porous ceramic membrane support by diluting to 50% by mass with ethanol, which lowered the viscosity of the ionic liquids, allowing them to better penetrate the 20 nm pores. We tested permeability and selectivity in a pressure test system, calculating change in pressure across the membrane to measure permeability by measuring pressure drop for different initial pressures (25-80 kPa). If selectivity decreased with increased pressure, we knew that facilitated transport occurred.

Jennifer Davis, '19
Biochemistry & Molecular Biology

Cherokee, IA
Craig Tepper

Vascular Correlates of Depression

A causal relationship has been found to exist between depression and cardiovascular disease (Fiedorowicz, 2014). Individuals with unipolar or bipolar mood disorders are approximately two times more likely to die from cardiovascular disease than the general population (Osby et al., 2001). A potential reason for this increased cardiovascular risk is greater inflammation of the vascular system that occurs during depressive episodes (Fiedorowicz et al., 2015).

We examined the impact of a unipolar or bipolar patient's mood on inflammation involving the vasculature. Inflammation can be determined by various methods including the determination of inflammatory mediators (C-Reactive Protein) and arterial stiffness. C-Reactive Proteins (CRP) are released into the blood by the liver during inflammation, and were measured using the Highly Sensitive CRP assay. Arterial stiffness was measured with pulse-wave velocity, in which the rate of pressure waves moving down a blood vessel can be determined. Our preliminary results show no significant correlation between mood and CRP count nor between mood and arterial stiffness. Data will continue to be collected until more certain conclusions can be drawn.

Marin Dettweiler, '19
Environmental Studies

North Branch, MN
Tammy Mildenstein

Mowing versus Non-Mowing in Eight Iowa Prairies

Iowa consists of less than 0.01% of its original prairies, which is why >1,600 parks in Iowa have acted to restore prairie. One way commonly used to restore tallgrass prairie is to burn half and mow the other half, which mimics disturbances that happen naturally. Because native plants have adaptations that allow them to survive these disturbances, native species can outcompete non-native invasive under this regime. While mowing can support the restoration of prairie plant populations, it is unclear how native animal species are affected. Monarch butterflies are specialists in the larval stage, depending on prairies for the milkweeds (*Asclepias syriaca*) that grow there. To understand how mowing affects monarch populations, we compared data from one of our survey sites which was unexpectedly mowed halfway through our monarch survey study season. The unmowed prairie closest to the mowed prairie was used as a comparison. Preliminary results suggest that although there was direct mortality of larvae from the mowing, subsequent monarch activity was high compared to the nearby unmowed prairie, making it difficult to ascertain the net result of the mowing event. Future analysis strategies will be discussed. This case study is only one of very few studies on this topic, and it includes a common restoration method. It is important to continue this research because monarch populations are quickly declining, and scientists across the U.S. are trying to figure out why and how to help them.

Marin Dettweiler, '19
Camden Grundeman, '19
Environmental Studies

North Branch, MN
Naples, FL
Tammy Mildenstein

Milkweed Numbers as a Limiting Factor to Monarch Populations in Tallgrass Prairies of Midwest, USA

Additional Authors: Libby Anderson, Belou Quimby, Baley Good, Peyton Ort, Jennifer Davis, Tammy Mildenstein

The United States Fish and Wildlife Service is currently considering a petition to list monarch butterflies (*Danaus plexippus*) as a candidate for protection under the Endangered Species Act. The recent plummet in monarch populations has been attributed to the reduction and degradation of prairies in the Midwestern states of the USA. The limiting factor within prairies would then most likely be the number of milkweeds, on which monarchs are dependent from egg through caterpillar stages. To understand the roles of milkweeds and prairies in monarch population growth, we studied milkweed and monarch populations in five tallgrass prairies across the summers of 2015 and 2016. We measured milkweed densities in the prairies and visited a sample of plants (n=275) twice each week to record the presence of monarch eggs, larvae, and butterflies. Using lifetable analysis, we measured the survival rates of monarchs between their life stages. The density of milkweeds across the prairies averaged 233 plants/ha. Only 21.7% of monarch eggs survived to become caterpillars, and survival rates among larval instar stages were extremely low. None of the eggs and larvae we tracked made it to the chrysalis stage. Our data do not support the hypothesis that the number of milkweeds in Midwestern prairies are limiting monarch populations. The large populations of milkweeds available to monarchs coupled with the fact most milkweed plants were not used by monarchs, suggest constraints to monarch populations beyond simply habitat availability. Other limiting factors to monarch populations need to be considered like predation on eggs and larvae, prairie patch size, and threats at the overwintering site and along migration routes. The current unprecedented scale of funding and collaboration for monarch butterfly conservation may be wasted if focused solely on prairie restoration.

Maimouna Dia, '18
French

Frederick, MD
Devan Baty

Patrimoine and the Commemoration of Slavery in Senegal

Tourism plays a role in the economic development, cultural identity, and collective heritage (*patrimoine*) of many nations. However, the growth of "dark tourism," or tourism directed to places identified with death and suffering, raises questions about the ways in which such sites are or should be commemorated. For example, the main tourist attraction in Senegal is the *Maison des Esclaves* and its door of no return--also known as the house where slaves were kept before they were sent off in the Atlantic Slave Trade. This site is economically and historically important to Senegal but controversies arise from the historical inaccuracies of narratives told at the site and from the commercialization of the site itself. In this presentation, I will examine the commemoration of the *Maison des Esclaves* site in Senegal in terms of its cultural, historical, and symbolic importance for the Senegalese themselves and other visitors. The purpose of this presentation is not only to examine this site in particular but also to foster discussion about the impact and control of historical narratives and symbols at sites commemorating slavery.

Polina Durneva, '19
Economics & Business

Moscow, Russia
Todd Knoop

The Effect of the TRI-Listed Carcinogenic Chemicals on the Incidence of Melanoma across the United States

As our society is becoming more and more environmentally conscious, people focus more on the detrimental effects of their industrial activities and explore ways to decrease the extent of potential hazards of such activities. The topic of environmental impact is thus gaining importance in many fields. This study explores the relationship between toxic chemical releases reported by the Environmental Protection Agency (EPA) in the Toxics Release Inventory (TRI) and melanoma, one of the most prevalent skin cancers in the world, and identifies the type of releases that had the most adverse effect on this skin cancer rate across 50 states. Toxics Release Inventory data from 1990, 1995, 2000, 2005, and 2010 were collected, filtered, and manipulated to estimate and assess the effect of chemical releases on melanoma in the year 2014. The chronic toxicity indices (CI) were also calculated for melanoma and several other types of cancer that share the same etiological factors with melanoma. The CIs help to account for the amount and toxicity of carcinogenic chemicals simultaneously. The regression analysis was conducted to assess risk from chemicals released into water and air. A series of different consequent multiple regression models were designed and built for the purpose of this study. Results of the study suggested that (a) 1990 is the most significant year to evaluate chemical emission for cancer rates in 2014, suggesting a 25-year lag between exposure and onset, and (b) of different forms of emissions, stack air emissions in 1990 had the biggest impact on the melanoma rates.

Julia Eastham, '19 **Milwaukee, WI**
Biology *Tammy Mildenstein*

What You Can Learn in Rehab: Notes from an Internship with a Wildlife Rehabilitation Center

Human interactions with wildlife have changed over the years. Long ago, we would leave them alone, unless we could gain something from them, like meat or hides. Now people recognize that our mere presence influences wildlife species, and we are more intentional about trying to coexist and help local animals we are affecting. Wildlife Rehabilitation Centers were created to help take care of the wildlife that have been injured by humans or by other environmental factors. Unlike domesticated animals, which have been bred to be easily cared for, wild animal species require different types of health care. There are many laws in place that limit how one can help a wild animal, as well as seek to address safety concerns. It is important to be careful when caring for wild animals whose natural response is to try to get free. It is also important that care is taken to limit interventions in the rehab process that may lead to the species being less wild, as ultimately, the goal is to treat the animal, so it can return to the wild. Over the summer of 2017, I worked at the Wisconsin Humane Society Wildlife Rehabilitation Center where I learned how to take care of wildlife and the laws and safety concerns that follow. It is important to educate others in proper handling of wildlife for the safety and well-being of both. In this presentation, I will share my experiences at the Center and provide my audience with best practices for interacting with wild animals and resources for responding to injuries in wild animals.

Shecharya Flatté, '18 **Iowa City, IA**
Politics *David Yamanishi*

The Role of National Stories in Creating the Conditions for Nationalist Genocide

This thesis examines the relationship between the stories nations tell about their history and the genocidal outcomes of certain nationalist movements. I focus in particular on the acts of genocide in Nazi Germany in the 1930s and 1940s, in the former Yugoslavia in the 1990s, and in modern-day Burma. By analyzing these cases, I identify the peculiar features of the particular nationalist movements that lead to acts of genocide.

Because national identity is, in most cases, an identity constructed by nationalist movements, it is essential to see how nationalists influence the national identity towards or away from features that may lead to genocide. I focus on the origin stories told by both genocidal and non-genocidal nationalist states. The origin stories of nations that ultimately perpetrate genocide have features that are absent in most non-genocidal nationalist movements. Nationalist movements that ultimately perpetrate genocide tell origin stories rife with themes of national victimhood and oppression. The nation, as a victim of this oppression, learns to fear and hate the perpetrators of this great crime; we see this in the case of Serbia: the Turks; in the case of Nazi Germany: the Jews; and in the case of Burma: Muslims. Although the future targets of nationalist ire are rarely perfectly congruous with the perpetrators identified by nationalist movements, nationalists construct an oppressor identity around a viable analogue that matches the perpetrators' religious, ethnic, or national identity. That analogue group is then scapegoated and ultimately targeted with crimes against humanity. By understanding the national stories told by burgeoning nationalist movements in the modern world, it is therefore possible to predict which movements are most likely to commit acts of genocide.

Marisa Flores, '19 **Colorado Springs, CO**
Biochemistry & Molecular Biology *Jeffrey Cardon*

Manipulation of Bacteriophage

Bacteria are the most abundant form of life on the planet. Bacteriophage is a type of virus that infects bacteria and are estimated to outnumber bacteria by up to a factor of ten to one. Phage therapy, a developing medical field that involves the therapeutic application of modified viruses, also requires an intimate understanding of bacteriophages. In order to characterize these viruses, they must first be isolated. The purpose of this research was to perfect a technique in isolating and growing phage that are specific for Gram positive bacteria, a group that includes common inhabitants of the human body, as well as several important pathogens. Specifically, we seek to observe viruses targeting *Staphylococcus epidermidis*, *Staphylococcus aureus*, *Strep*, and *Micrococcus luteus*.

In addition to this main purpose there were several smaller projects in the works: the induction of lysogenic *E. coli*, *S. aureus*, and *S. epidermidis*, the concentration of *E. coli* and *Staph* phage, and amplification using PCR of virus specific DNA found in Mt. Vernon wastewater. The specific viruses we looked for were T4, herpesvirus, and adenovirus. T4 is a phage of *E. coli*, while herpes and adenovirus are human viruses. These extra projects were performed to attempt to better understand bacteriophage.

The next step in this research is to develop virus isolation methods for soils, as viruses in soil are sticky and difficult to remove from the soil. The medical potential of bacteriophage means this research will continue to be relevant until a consistent successful isolation method can be created.

Samantha Frese, '20 **St. Louis, MO**
Music *James Martin*

Beauty in Amalgamation: A Study in Phantasmagoria in Visual Kei

Visual Kei is a Japanese art form that emerged from the Japanese rock scene in the 1980s. Often referred to as a music genre, Visual Kei is filled with variety, with every song using elements found throughout different cultures and time periods. The lyrics utilize not just Japanese, but English and French as well. Live performances reveal lavish costumes, movements somewhere between dancing and acting, and set designs usually reserved for theatrical stages. Every component of the art relies on being shocking and dramatic. In an artform defined more by difference than similarities, fans, musicians, and the music industry have struggled to define Visual Kei for years. I demonstrate that what "defines" Visual Kei is phantasmagoria. While the main focus is on music, Visual Kei accepts the visual as equally important to the spectacle and to the immersive experience of the artwork as a whole. This combining of so many different elements into one work leads to an overstimulation of the senses, creating a visceral, dream-like experience. I use Adorno's ideas of phantasmagoria as a starting point for exploring the relationships that form among phantasmagoria, Visual Kei, the artists who create it, and the people who view it. The immersive nature of phantasmagoria greatly affects the lives of both fans and performers as dichotomies between past and present, Japanese and foreign, reality and fantasy, and even performer and fan are diminished.

Kate Gielas, '20 **Falcon, CO**
Theatre *Caroline Price*

Fiery Determination

In the fall of 2017, my good friend, Benjamin Wong, told me to audition for his show, *Our Stories*. The story I wrote, "Fiery Determination," was about the challenges I've faced since a car accident I was in in 2013 and how I've overcome them, challenges such as bodily pain, loss of friendship, and self-harm. This story, which I will share during this presentation, is about how I overcame being at the lowest part of my life, to where I am now. I wrote this story because I wanted to inspire people, to tell people they can overcome anything regardless of the suffering they've been through.

Because "Fiery Determination" was the story I auditioned with, it was something I constantly came back to during the process and ultimately decided to perform. The first time I told my story in front of the group, I started crying. Putting my story out there might make me vulnerable, but I believe my story can help people who have dealt with similar issues. If my story only helps one person, then that's one person I've helped; for me, that is what *Our Stories* was all about. *Our Stories* was a community that came together to write and share stories and "ended" with close friendships, self-realization, and shared stories of experiences.

Cassie Gill, '18 **Seattle, WA**
Dance *Alvon Reed*

The Music and the Mirror

Stereotypically, female dancers sit between sizes zero and six, between 5'4" and 5'10", and between pale and pasty. Akira Armstrong, who is none of the above, is the founder of the Pretty BIG Movement, a dance group based in New York City that specializes in giving voluptuous women a platform, not only to showcase their talent and ability as artists, but to create understanding and awareness for the adversity we face. Currently, I weigh 225 lbs as a 5'1" woman. Alongside this fact comes a whole host of assumptions: I am not strong; I am not flexible; I'm not graceful; I'm not healthy. And therefore, I am not a dancer. How do plus-size dancers and artists carve out a place for themselves in this exclusive world?

Plus-size dancers deserve a platform for artistic expression. Through research of the plethora of body-diverse dancers and artists, such as Akira Armstrong, and choreography of the song "The Music and the Mirror" from *A Chorus Line*, I will demonstrate that dancing created by plus-size artists and for plus-size artists can be engaging, emotional, and entertaining. My choreography and research prove that weight is not a limitation but something that, when embraced, creates beautiful artwork.

Kimberly Gordon, '19 **Phillipsburg, KS**
Russian *Lynne Ikach*

Life as a Russian Orphan

The content displayed by this poster will outline information regarding the living conditions of Russian orphans and their place in society. Each year, thousands of orphans are quietly forced through the complicated and largely inadequate state system and pushed out of their institutions between the ages of sixteen to eighteen. As I have had the privilege of meeting with many Russian orphans, the poster will also portray some of the unique experiences they relayed to me. I collected this information during an internship last summer with SOAR (Service & Outreach Alaska to Russia) International Ministries, for which I received Cornell Fellows funding. I had the opportunity to study the Russian language and culture while volunteering in two of their facilities: one in Ryazan and the other located in Podolsk, Russia. While I was there, I learned first-hand the reality of living conditions for these individuals and collected general data about orphans all over Russia.

Gage Griffin, '20 **Lake Forest, IL**
Biology *Tammy Mildenstein*

The Effect of Pond Size on the Health of Bluegill

Across the state of Iowa are many types of water bodies that serve different purposes to Iowa's citizens and wildlife. However, the Iowa Department of Natural Resources (Iowa DNR) has insufficient resources to focus conservation efforts on small local bodies of water, including retaining ponds, in the local area. Due to the lack of funds, supplies, and man power, the Iowa DNR is unable to properly survey the small retention ponds to determine if they can support healthy fish populations. However, money is spent every year by this department to stock fish into these potentially unsuitable waters. I surveyed the health of local Bluegill (*Lepomis macrochirus*), a common species of panfish across North America, for one large lake and five small ponds. I computed the average fish health for each water body using the relative weight calculator provided on the Iowa DNR's website. These values determined the viability in supporting healthy Bluegill. Due to the small scale of this study, we need to collect more data prior to investing money and time to improve bodies of water. Through the use of local anglers as citizen scientists, we can use the data collected by fisherman to access fish health in these overlooked bodies of water. Studies such as this can support the Iowa DNR's efforts and improve the conservation of Iowa native species.

Sabine Hahn, '18
Biology
Barbara Christie-Pope

Cellular Stress and Senescence as a Pertinent Factor in in vitro Merkel Cell Polyomavirus Replication

Merkel Cell Polyomavirus (MCPyV), a small DNA virus, has been linked to a form of skin cancer called Merkel Cell Carcinoma (MCC). MCC is an aggressive skin cancer that has a 35 to 50% mortality rate, and 80% of MCC tumors contain MCPyV genomic DNA (Paulson et al., 2010; Liu et al., 2016). Studies involving MCPyV could yield valuable information, as cases of MCC have been skyrocketing within the last three decades correlated to an increase in the elderly demographic and an increase in incidents of detrimentally prolonged UV radiation exposure (Wendzicki et al., 2015). The expression of the early genes, specifically Large T (LT), can help indicate the presence and replication of MCPyV (Paulson et al., 2010). In many MCC tumors, MCPyV genomes were observed to have integrated into the cellular genome. UV radiation and aging are two known propagators of cellular stress in MCC that cause tumorigenesis (Liu et al., 2016). UV radiation has been hypothesized to promote both viral infection and viral replication (Larbi et al., 2013; Liu et al., 2016). We examined several fibroblast cell lines (*PFSK-1* and *hTERT*) to determine which cell line was more amenable to transfection by religated MCPyV DNA and whether or not stress is involved in replication of the virus. We demonstrated, through green fluorescent protein (GFP) immunofluorescence, that *PFSK-1* cells could be more efficiently transfected than *hTERT* cells. Two different chemical stressors and one physical stressor were applied to the transfected cell cultures in order to induce cell stress: mTOR inhibitor pp242, doxorubicin, and ultraviolet light, respectively. Here we demonstrate that measurable amounts of viral gDNA and viral presence after transfection could be observed, and mTOR inhibitor and UV light stressors seemed to encourage viral gDNA replication in both cell lines.

Jessica Halter, '19 — **La Crosse, WI**
Emma Meyer, '19 — **Delano, MN**
Maureen Sullivan, '18 — **Arlington Heights, IL**
English & Creative Writing — *Leslie Hankins*

Republication of Winifred Mayne Van Etten

Winifred Mayne graduated from Cornell College in 1925, and after teaching at a high school in Emmetsburg, New York, Mayne returned to Cornell as a professor in the Department of English. In 1934, Winifred Mayne married Ben Van Etten '28 and was subsequently released from the faculty. Her time was spent on the creation of her 1936 novel, *I Am the Fox*, which won the $10,000 Atlantic Monthly Press and Little, Brown and Company Prize for "the most interesting and distinctive contribution." With the prize money from her best-selling novel, Winifred and Ben built a house which would come to be known as the Van Etten-Lacey House, Cornell's Center for the Literary Arts. In 1937, Mayne Van Etten returned as a professor of English, following the publication of her novel. She taught at Cornell until 1968, editing and contributing to Cornell's literary journal, *The Husk*. Mayne Van Etten's years teaching aspiring writers and her works of fiction still affect readers today.

During the 2017 Cornell Summer Research Institute, we worked as a small editorial board to republish three of Winifred Mayne Van Etten's short stories. Under the tutelage of Professor Leslie Hankins, we built an understanding of the processes involved in small publishing and editing and then used those skills on our own projects. After archival research delving into old copies of *The Husk*, we each selected a story we wanted to republish. We worked closely together as we proofread the text, set the layout using Adobe InDesign, created covers and other visual aspects, wrote short essays to provide some context about the works, and ultimately printed brand new annotated and illustrated editions of these stories. It is the hope of Professor Hankins and all of us that our efforts will create some much-deserved appreciation for the work of Mayne Van Etten and bring attention to the remarkable woman herself.

Katherine Heidt, '18 — **Palo, IA**
Chemistry — *Charles Liberko*

Extraction of Metal Ions from Water Using Lignin Isolated from Sawdust

Additional Author: Charles Liberko

Clean, safe water is necessary; however, clean water is not widely available throughout the world. There are cheap and effective ways to remove biological threats such as bacteria, but only expensive chemicals and processes have been developed to remove toxic heavy metal ions. An alternative may come from lignin, a polymer found in wooden material. Lignin is currently widely available and is used in recycled papers like newspaper, but not much else. The structure of lignin changes from material to material, but always has the basic component of phenols. These phenols give lignin the potential to remove heavy metal ions from water, as they can adopt a negative charge that will attract the positive charge of the metal. Lignin was isolated by heating sawdust in an oven for an extended period of time before it was placed into solutions of iron, copper, and nickel. Simple color complexes form to test concentration of the metals in solution. Lignin was successful at removing most of the nickel and iron, and a majority of the copper. Therefore, heavy metal ions can be removed from water through the use of lignin. This could be implemented to drinking water, making it safer to drink.

Oriana Henney, '18
Psychology

Central Point, OR
Melinda Green

Catalysis Incorporated: Innovative Healthcare for the Future

The three biggest issues in healthcare today are accessibility, affordability, and quality. Quality of healthcare would encompass what a patient is being treated for: readmittance rates, wait times, stay time, etc. In today's healthcare system, doctors treat patients symptomatically instead of holistically and have a large re-admittance rate (patient re-visiting hospital within 30 days of first being seen). There is a large amount of miscommunication or no communications between various mental health and physical health physicians, nurses, and patients leading to unnecessary tests, mis-diagnoses, and mis-calculated or requested drugs.

My internship was a case study of Catalysis, a company located in Appleton, Wisconsin, focused on networking with health care facilities around the world to improve overall patient quality and experience. Catalysis does this through products, events, summits, education, and networking. Although Catalysis is a small office, the company has a large network of hospitals, and other industries, located all over Canada, Europe, and the United States.

While traveling to Toronto, Canada and Seattle, Washington, I observed Lean practices. Lean is a concept taken from the auto industry and has been applied to healthcare within the last ten years. Lean teaches hospitals and employees how to communicate between frontline staff, management, and administration, as well as how to provide quality services while cutting out unnecessary costs of healthcare. This is done through visual management techniques and constant consistent communication between all staff in each and every department. These same techniques are used with other industries that also implement Lean practices such as Boldt Construction and TIDI Supplies, which I was able to tour while observing Catalysis. I attended conferences and seminars to observe the differences in how Lean was implemented.

Through my internship, I observed how visual management can have a positive impact on any industry and help facilitate better team dynamics. There is some resistance to the catch-all phrase of "Lean" itself; however, hospitals around the country are still adopting similar practices. I witnessed how Lean aspects are the future of healthcare, how all health care systems should be organized. Catalysis taught me a whole new way to visualize my goals, my streagnths, and my abilities to make change in the healthcare field.

Marshall Hobson-Ritz, '18 **Kenmore, WA**
Physics & Engineering *Derin Sherman*

Measuring the Sun's Radio Temperature

When the average person visualizes a telescope, an optical telescope comes to mind even though there are many regions beyond the visible part of the electromagnetic spectrum that telescopes can take measurements in. Radio telescopes observe radio waves instead of waves in the visible part of the electromagnetic spectrum. One advantage of a radio telescope is that observations are not dependent on clear weather conditions, unlike optical telescopes.

I built a radio telescope, using a commercially available radio JOVE kit, to record data that would be a proof of concept that Jupiter's storms emit radio waves. However, these storms typically need long hours of observation and ideal storm conditions to detect these signals. When observations were taken this July, no signals that were clearly from Jupiter were detected. During the PHY 312 course in November, I was able to repurpose my telescope.

During the class, Jupiter's position in the sky was very close to the Sun making it impossible to observe. Instead, I repurposed the telescope to measure the Sun's effective radio temperature. I compared my observations to data recorded by others along with concepts within literature to determine what region of the Sun I was observing and why that region of the sun would be emitting radio waves.

Marshall Hobson-Ritz, '18 **Kenmore, WA**
Physics & Engineering *Kara Beauchamp*

Modeling the Shape of the Rosette Nebula

The Rosette nebula is a region in outer space that is comprised of gas and dust particles and is a star-forming region. The nebula is around 5,000 light years away; this makes it very difficult to know the 3-dimensional shape of the nebula. Creating a good model for the 3-dimensional shape is important when making calculations for important quantities for a nebula, such as the magnetic field strength. We modeled the 3-dimensional shape of the Rosette nebula using radio wave data from the 1980s. We created models by estimating the thickness of the nebula along the line of sight, the pathlength, at any given point in the nebula. Pathlength was generated by calculating the depth of geometrical objects that we determined plausible for the overall shape. Since the shape of the Rosette nebula looks circular in our 2-dimensional image, it was determined that it would be important to apply different models that are spherical and cylindrical to find what kind of shape would fit best. We then used the pathlength value and the radio data to calculate the electron density at every point. From this calculation, we created electron density histograms and color mappings. We used this combination of qualitative and quantitative analysis to determine which would be the best model for the Rosette nebula.

Cole Horan, '18
Physics & Engineering

Englewood, CO
Derin Sherman

Wireless Power Transmission from Evanescent Waves

Electricity is a necessity in today's day and age. There are more devices and electronics that are wireless. Phones, radios, and the internet are examples of wireless information in today's age. Wireless power transmission would be useful so that electronics could be powered or charged from a distance. This is by no means a new idea; Tesla experimented with the idea, and recently, researchers at MIT proved the feasibility of mid-range power transfer. Evanescent waves can communicate in the near-field region and then decay over distance. These waves can be used when combined with magnetic resonance to generate efficient wireless power over short distances. The purpose of this research was to experiment with the feasibility of using evanescent waves combined with magnetic resonance to wirelessly transmit power. This was done by building upon previous work from other Cornell groups to create circuits and components that would improve the system. We were able to transmit evanescent waves with our system at around thirty percent efficiency. With more improvement to the efficiency and circuitry, devices could be created that could wirelessly charge electronic devices from a short distance using this method.

Amber Jerson, '20
Spanish

Bettendorf, IA
Marcela Ochoa-Shivapour

La Ceguera Durante la Época de Franco (*en Español*)

The short story, *La lengua de las mariposas* (The butterfly's tongue), by Manuel Rivas, and the play, *En la ardiente oscuridad* (In the burning darkness), by Antonio Buero Vallejo, are two works from Spanish authors that take place during the Spanish Civil War (1936-1939). Both authors explore the fight for freedom under General Francisco Franco's dictatorship. Before analyzing both works, I provide a short bibliography on the authors, as well as a short summary of Franco's rise to power in Spain. This is done in order to make the readers aware of the social, historical, and political background of the two works.

Through a comparative analysis, I connect both works, sharing common metaphors that are used to reflect how the dictatorship affects the society at the time, especially the struggle that intellectuals faced under Franco's brutal regime. I am particularly interested in the themes surrounding blindness as a metaphor for the Spaniards who were not able to see the travesties that Franco committed during his dictatorship. Furthermore, the dichotomy of light and darkness helps to address the constant topic of freedom versus oppression shown in both works. Finally, the presence of blind characters or characters in need of a cane summarize my thesis even more. *La lengua de las mariposas* and *En la ardiente oscuridad* represent a painful and traumatic period of Spanish history. At the same time, both works, using similar metaphors, try to open the eyes of the readers or the audience with a new light and allow them to see a part of history from a different perspective that may not have been previously available to them.

Nina Kahn, '18 **Boulder, CO**
Biochemistry & Molecular Biology *Barbara Christie-Pope*

Vesicles, Dopamine Neurotoxicity, and Parkinson's Disease

Parkinson's Disease (PD) is a disorder that results in movement deficits such as loss of muscle control, difficulty initiating movement, tremors, lack of facial expression, and stiffness. These deficits are caused by the loss of specific neurons in a region of the brain that controls movement. These neurons contain the neurotransmitter dopamine (DA) and are located in an area of the brain called the substantia nigra. The cause of degeneration of these DA neurons is unknown, but there is evidence to suggest it may be related to DA itself (Pifl et al., 2014). We examined TRPM7, and the potential role it may plays in preventing DA-induced toxicity and cell death. We used a cell culture model of DA-containing neurons (SH-SY5Y cells) and treated them with 1-methyl-4-phenylpyridinium (MPP+), a drug that only affects DA-containing neurons. MPP+ competes with the normal mechanism where DA is loaded into the vesicles by the protein VMAT2, therefore DA is not loaded into the vesicle, increasing the formation of toxic substances (Decker et al., 2014). We investigated the potential role of the other protein in this mechanism by treating the cells with an inhibitor of TRPM7. If TRPM7 is involved in this mechanism, cells treated with an inhibitor of TRPM7 and MPP+ should demonstrate enhanced cell death due to blockade of both proteins. We determined the percentage of living vs dead cells with and without incubation with MPP+ and TRPM7 inhibitor (NS8593). We demonstrated that inhibition of TRPM7 resulted in an increased sensitivity to MPP+. Cells incubated with MPP+ and NS8593 showed a 53.7% increase in cell death over MPP+ alone. These results suggest that defects in TRPM7 decrease the ability to remove DA from the cytoplasm, supporting the hypothesis that increased cytoplasmic DA may be involved in the degeneration of dopaminergic neurons in the substantia nigra.

Nina Kahn, '18 **Boulder, CO**
Kinesiology *Kristin Meyer*

Kinesthetic Classrooms: A Review

In the United States, there has been an increase in sedentary lifestyles in children, with less than half of America's youth meeting the recommended physical activity requirements set by the Center for Disease and Control. Schools in recent years have been cutting recess, breaks, and physical education to maximize time for learning. This has greatly increased the lack of in-school physical activity of students and may be affecting their healthy habits, as well as their cognitive abilities. Studies on physical activity have shown exercise positively affects learning cognition by enhancing short-term memory, attention, executive function, and neuroplasticity. Based on these findings, researchers and educators have been looking at options to increase physical activity without interfering with the time set aside for learning. One of these options has been the implementation of kinesthetic classrooms. These classrooms use alternative desks and seating such as standing desks, therapy balls, cycle desks, and other equipment that allow students to autonomously move. However, it is unknown how much student physical activity has increased within these classrooms or if there are any cognitive benefits to pairing movement with learning. I have taken the initial steps into formulating a research proposal and writing a grant that would allow me to research the effects a kinesthetic classroom has on cognition. Additionally, I have conducted a study on the relationship between childhood and adult movement and investigated the reasons people choose to move in class to see if movement during class equates to distraction.

Kasper Kittredge, '18
Mathematics & Statistics
Tyler Skorczewski

Modeling Archery Performance

Often, people will discuss the process of learning as a 'learning curve,' a continuous improvement in one's retention and ability. But what if learning isn't continuous? What if learning occurs on discrete performance levels? We explored the idea of discrete performance levels using archery scores. Taken from the database of the National Archery in the Schools Program, we analyzed the performance histories of middle- and high-school Iowan archers to see if we could observe these performance levels. We then compared the results from the performance level analysis to the results from a more traditional learning curve analysis. This methodology can be generally applied to any situation where one wants to measure improvement with quantitative data. In this presentation, we discuss the results of our comparison as well as other information the performance levels reveal.

Amanda Leimbach, '18
Biology
Boulder, CO
Craig Tepper

Can Coral Beat the Heat?

Additional Authors: Tim Globokar, Craig Tepper

Symbiodinium is a photosynthetic algae that forms symbiotic relationships with numerous marine organisms that reside in shallow oceanic reefs (Fournier, 2013). The algae converts light and CO2 into organic compounds which can be used by the host in metabolic pathways. In return, the host provides protection and CO2 to the symbiont (Yellowlees et al., 2008).

The *Symbiodinium*-host association is primarily found in two different phyla, Porifera (sponges) and Cnidaria (corals, sea anemones, and jellyfish). *Symbiodinium* is classified into nine different clades (A-I). Different clades provide the host with specific physiological benefits. For example, clade D provides *Acropora* (a scleractinian coral) with a higher degree of ocean thermal tolerance compared to those coral that contain Symbiodinium clades other than D (Jones et al., 2008).

We are examining the *Millepora* (hydrozoan fire coral) –*Symbiodinium* relationship at two thermally different locations in the Caribbean: San Salvador, The Bahamas (22o-28 oC) and South Water Caye, Belize (26 o-30 oC). Our preliminary results indicate that healthy fire coral in The Bahamas are dominated by clade B (N=72). In Belize, however, individual coral colonies are dominated by either clade A (N=31) or clade B (N=12). We have observed that clade A dominant fire coral are healthy while clade B dominant fire coral are beginning to show signs of bleaching (loss of *Symbiodinium*). Bleached coral are more susceptible to disease and are less likely to recover. Our next step is to understand the physiological benefits that clade A provides to fire coral in Belize.

Jay Marshall, '18
Physics & Engineering

Prescott Valley, AZ
Derin Sherman

Various Methods of Experimentally Measuring the Radius of Atoms: The Ramsauer-Townsend Effect and Electron Diffraction

Particles and atoms are the building blocks of our known universe; their interactions and properties shape the physical world. They are invisible to us in our daily lives, and many don't understand their properties. In this experiment, I sought to measure the radius of atoms through two different but similar methods. The Ramsauer-Townsend effect was used to measure Xenon atoms, and electron diffraction was used for Aluminum atoms. In both methods, electrons are accelerated towards atoms, and the interactions between the particles is what allowed me to determine the atomic radius.

The Ramsauer-Townsend effect is an observable phenomenon where at certain energy levels, it appears that the electrons are not scattering off the atoms. Using a device called a Thyratron, I was able to vary the energy of the electrons and measure the rate at which the electron scattering was occurring. With this data, I calculated the radius of the Xenon atom using first a one-dimensional model, and then a more accurate three-dimensional model.

Electron diffraction is similar in that it also relies on electrons acting like waves. However, we instead examine the pattern that results from the diffraction of electrons off the atoms. Electrons were passed through a thin film of poly-crystalline aluminum and by examining the pattern, I was able to determine the radius of the atoms.

The methods used are similar to higher energy experiments used in modern physics research. Scattering is an extremely useful technique used to determine particle properties, though at much higher energies than in my experiment, and with various other particles.

Victor Martinez, '18
Chemistry

Chicago, IL
Jai Shanata

The Production of an NMDA Receptor Via Recombinant Protein Expression for the Electrophysiological Analysis of its Activity When in the Presence of Donepezil and Memantine

In 2017, Alzheimer's disease was reported as the 6th leading cause of death in the United States, with more than 5 million reported cases. In addition, it is estimated to cost the nation $259 billion in health care and predicted to rise to $1.1 trillion by 2050. Two well-known therapeutic agents, Memantine hydrochloride, an N-methyl-D-aspartate receptor antagonist (NMDAR), and donepezil hydrochloride, an acetylcholinesterase inhibitor, are oral pharmaceuticals co-prescribed to treat individuals with Alzheimer's disease. A previous study, using computational analysis to determine the affinities of each drug to an NMDAR, suggested donepezil (-9.0 kCal/mol) as the drug with a higher affinity when compared to memantine (-6.4 kCal/mol), the NMDAR antagonist. The data indicated donepezil as the better drug for the NMDAR binding, which provided information for future potential drug-candidates, or ways to modify existing drugs. By producing, and introducing, a recombinant expressed NMDAR protein onto an artificial membrane by fusion, the data from the previous study are to be verified using a different system of analysis, electrophysiology.

Mara McLaughlin, '18
International Relations

Crested Butte, CO
David Yamanishi

The Participatory Approach to Development: A Case Study of the Comprehensive Rural Health Project

In the field of development, many theorists have argued for one approach or another to create economic, social, and political growth. However, the question of what successful and sustainable development truly means is a question that many thinkers have not addressed. What this type of growth means for the people living in developing countries, experiencing development challenges, on a day-to-day basis is another facet of this question. Bottom-up theories of development argue for development to occur through the people, not through large government or international policies. One such theory is the capabilities approach, which argues for a recognition of individual capacity and agency. The participatory approach to development mirrors this theory, which argued that local participation is the most successful and sustainable way to create development. Instead of looking for fast-paced aggregate growth, this strategy advocated learning from the local people about their own problems, and creating longevity in the solutions by giving the people a stake in their development.

One particular non-governmental organization in India, the Comprehensive Rural Health Project (CRHP), acts as a case study for both bottom-up theories and practice of facilitating development that lasts and that improves the lives of all through an analysis of its methodology and a comparison of its tactics with other similar NGOs globally. CRHP has managed in the last forty years to nearly eradicate all serious communicable diseases in a large area, reduce social stigmatization of marginalized groups, increase economic growth and production, increase sanitation and water accessibility, and promote women's rights and empowerment. The undeniable accomplishments of CRHP in India can and has been replicated around the world in varying contexts and conditions, as the Jamkhed Model is designed to be flexible and versatile.

Through an analysis of bottom-up development theories, of the participatory approach to development, and of the ways in which CRHP has successfully utilized these theories and strategies to raise the standard of living in rural Maharashtra, India, potential implications for the field of development overall can be seen. This conclusion is the culmination of my research in India at CRHP, as well as my honors thesis focus on successful and sustainable development theories, practices, and successes around the globe. With a scholarly investigation into development and results from two other NGOs, I have been able to cultivate an understanding of development, as a whole, and what it can mean on a local and global scale.

Samantha Nadel, '19
Chemistry

Houston, TX
Cynthia Strong

X-Ray Fluorescence and Inductively Coupled Plasma Spectroscopy Analysis of Huston-Fox Pottery

The presence of Riggs and Fort Yates wares at Huston-Fox (39MD133) has long been known to archaeologists, but the reason for the wares being so far from the Middle Missouri, the cultural region for which these wares are associated, is less definitive. These sherds are the result of limited excavations supervised by the late Dr. Robert A. Alex, Director of the South Dakota Archaeological Research Center in 1984 and 1985. An XRF (X-Ray Fluorescence) analysis of a sample of sherds and clay from Huston-Fox was conducted to determine if the pottery was made at Huston-Fox or somewhere else. The analysis revealed that most sherds, including most of the diagnostic sherds, belonged to the same cluster as the clay, but the limitations of XRF demand caution before asserting their definite local origin. ICP-OES (Inductively Coupled Plasma-Optical Emission Spectroscopy) analysis was also conducted on modern pottery to determine the reliability of XRF results; 64% of 11 studied elements were determined to be highly or fairly accurate in XRF.

This presentation will further discuss the archaeological significance of Huston-Fox, the chemical principles behind XRF and ICP-OES, the statistical analysis conducted, and continued research stemming from the original project. In addition, the smaller exploratory experiments conducted to formulate robust research protocols and to strengthen the study's conclusions will be discussed.

Huong Quynh Anh Nguyen, '19
Chemistry

Moscow, Russia
Charles Liberko

Analytical Exploration of Dimerization and Aggregation in Methylene Blue

Methylene blue is a dye used in biological and chemical assays as well as a pharmaceutical drug for treating methemoglobinemia. It is known to dimerize in high concentrations of the dye in water. Aggregation or dimerization is self-assembly of individual molecules or ions held by together by weak intermolecular forces[1]. Ionic compounds such as methylene blue aggregate at relatively high concentration[2], and by increasing the ionic strength or concentration of the dye, it aggregates more strongly. Researchers have not yet determined the structure of methylene blue dimer in aqueous solution. One structure which has been proposed is antiparallel, in which the sulfur atom of one methylene blue molecule is situated above the nitrogen atom on the other methylene blue molecule. This dimer structure has the lowest energy and is more stable.

Based on UV-vis and NMR experiments on methylene blue, we believe that the structure of methylene blue dimer is parallel, with a big off-set on the short axis, but with slight off-set on the longer axis. This research gives a novel way of looking at and figuring out the structure of all dimers.

Robert O'Hayre, '18 **Gunnison, CO**
Economics & Business *Todd Knoop*

Traveling as an Economist

This presentation will discuss the economic causes of cultural and societal differences between China and the United States. A combination of Solow and Romer growth models combined with behavioral economics make explaining these differences fairly straightforward. In doing so, these models provide insight into the costs and benefits of certain government and individual choices. Specifically, this presentation will analyze the impact of recently proposed tariffs on steel imported from China to the United States using observations from a visit to Bao Steel in Shanghai. An explanation of Chinese marriage markets and the absence of a drinking age in China will follow. Finally, this presentation will investigate the efficiency of certain transportation methods in China relative to comparable options in the United States.

Together, these analyses will show that all people have similar physical and social needs, but these needs are fulfilled differently across cultures. Realizing that differing behaviors are responses to their environments from people who are fundamentally the same is one of the most important insights that comes from traveling as an economist. This insight, which comes from bonding with a foreign culture, makes economic reality much clearer than any theoretical model can.

Neil Pagdin, '17 **Freeport, IL**
Thomas Greene, '19 **St. Albans, UK**
Kinesiology *Christina Johnson*

Still in the Game: The Influence of Competence, Relatedness, and Autonomy on Vitality among Older Adults

Exercise is a necessity to maintain a healthy and happy life (U.S. Department of Health and Human Services, 2008). The purpose of this project was to examine perceptions of exercise among adults over the age of 50. Our research consisted of 56 life history narratives about health, activity levels, stress, and dietary habits. Data was gathered through one-on-one interviews of people in the Mount Vernon, Coralville, and Solon communities. Participants indicated they understand the health benefits of exercise, but did not express a deeply held sense of ownership over their movement practices. Using Self-Determination Theory's (e.g., Ryan & Deci, 2001) concept of basic psychological needs as a framework for data analysis, we focused on the ways in which individuals' vitality connected to their articulation of perceptions of autonomy, competence, and relatedness. This sense of vitality can be achieved by maintaining a perception of autonomy, relatedness, and competence in a person's everyday activities. These "basic psychological needs" (autonomy, competence, and relatedness) can be fulfilled in exercise contexts. However, older adults differ greatly in the extent to which they articulate and experience fulfillment of these needs. These results suggest the importance of emphasizing ways in which health practices like exercise can support older adults' basic psychological needs.

Danielle Polson, '18
Environmental Studies

Fresno, CA
Rhawn Denniston

Stable Isotopic and Environmental Responses to Climate Variability in Three Northwest Australian Caves

Geologists study cave formations (stalagmites, in this case) to understand past climate conditions in the tropics. Stalagmites are mineral deposits composed of calcium carbonate and are useful because they can grow continuously for thousands of years, be dated precisely using the radioactive elements they contain, and record rainfall intensity in their oxygen isotope ratios. However, secondary effects, such as evaporation of cave drip water or changes in cave temperature, can complicate the climatic indicators in stalagmite oxygen isotopes. Therefore, it is critical to understand how each cave's environment changes over time.

We studied three caves (KNI-51, Ball Gown, and Star Chamber) along a 1700 km transect in northwestern Australia where stalagmites have been used to reconstruct prehistoric climate. In this region, there is a summer monsoon (wet) season and a winter dry season. Of interest to this study are (1) the seasonal variability in temperature and humidity and (2) the relationship between rainfall and infiltration into the caves. At each site, data loggers have been continuously recording environmental variability, such as drip rate within the cave, rainfall, temperature, barometric pressure, and relative humidity, since 2015. We report the results of the first two years of this study.

We assessed the link between rainfall and infiltration into the cave using rain gauges, a nearby weather station, and acoustic drip counters. Each cave responded differently to seasonal changes in temperature and humidity, and responded differently to discrete rainfall events. At KNI-51 cave, the drip rates at two sites within the cave increased only slightly after rain events. Air temperature varied little throughout the year, with a mean value of 28.8±0.6˚C during the wet season and 28.7±0.7˚C during the dry season. The humidity levels were also constant at ~100% throughout the year, in part because the cave entrance is ~600 m long.

Ball Gown cave's drip and infiltration rates were difficult to interpret because the drip data were vastly different from the weather station data. This cave has an entrance at either end of the cave system and thus air flow is higher than at KNI-51. As a result, humidity [93.8±8.9% (wet season)/92.6±9.8% (dry season)] and temperature [24.0±1.0˚C (wet season)/(23.8±1.2˚C (dry season)] were more variable. At Star Chamber cave, the drip rates doubled a few days after a rain event, and then decreased quickly until the next rain event. The temperature in Star Chamber was constant at 25.9±0.3˚C.

Stalagmites can be useful tools for recording climate. Their isotopic signatures can act as a proxy for paleo- and current rainfall records. However, multiple obstacles could affect the accuracy of their recordings. These obstacles need to be accounted and tested for.

Quinn Quintana, '18
Kinesiology
Kristin Meyer

Sports: Women vs. Media

Since the enactment of Title IX in 1972, there has been a significant increase in the opportunity and participation of women in athletics. This has had a ripple effect from youth sports all the way up to professional sports, but the amount of media on female athletes has not increased. There has been, in fact, a significant decrease in the percentage of media coverage on female athletes in the past 30 years. In addition, coverage of female athletes continues to be centered around the sexualizing of the athlete instead of their athletic accomplishments. Using Duncan's guidelines for sports photo analysis, a case study was performed on *Sports Illustrated*'s 2017 Swimsuit edition cover feature of an Olympic medal gymnast. With a surge of women into athletics, there should be an equalization in the amount of the media coverage as well as the type of coverage that they are receiving.

Rachel Renaud, '19
Ypsilanti, MI
Classical Studies
John Gruber-Miller

Defining Social Communities in Catullus

Catullus is well known for diving into taboo topics, using crass language, and insulting others when they violate social norms. Why does he respond this way? When someone steals his napkins, insults his poetry, or gives him a gift of bad poetry on the Saturnalia, Catullus uses his wit and his verse to point out the faux pas. Interestingly, there are differences between how Catullus insults and rages at strangers versus acquaintances or close friends. In Poem 25, Catullus is angry with a stranger. His written abuse is broad and could be applied to anyone. The threats within the poem are aimed at the man's social standing and would hurt his interactions in the community. Acquaintances, such as those in Poem 16, receive targeted insults. The inspiration is drawn from shared events and their knowledge of each other. Catullus uses that shared knowledge to point out that they should know him better and how they ought to be ashamed for mischaracterizing him. Finally, close friends receive a different treatment in Poem 14. There is shared history and shared commitment to poetry and intimate bonds of friendship to draw upon, even more so that in Poem 16. However, the insults and anger are being deflected onto other targets within the poem. Catullus only seems to want to vent to his friend, angry but not wanting to hurt his friend. All the insults, regardless of the recipient, pull on the social, hierarchical, and gender roles of Roman society. In conclusion, there is a difference between the three types of people and the way Catullus talks about them in his poems. The level of relationship determines how Catullus reacts and what the insults are designed to do.

Sara Renaud, '18 **Ankeny, IA**
Medieval & Early Modern Studies *Michelle Herder*

Christine de Pizan's Authority in Writing *City of Ladies*

In previous studies on Christine de Pizan and her book, *City of Ladies*, scholars have mentioned clues as to why she is the authority on the defense of women at her point in time. My project aims to tie these pieces together to firmly establish her as the leading authority on the subject at the time of the publication of *City of Ladies* in 1405. This is done through placing Christine within the context of her time period, analyzing the progression of her body of work, delving into her use of allegories, evaluating the significance of her patrons, and examining the control she possessed in the manuscript publication of her work.

Rory Riordan, '20 **Oak Park, IL**
Spanish *Marcela Ochoa-Shivapour*

How Characters Grow and Evolve: An Analysis of Natural Characteristics in Rivas' "La Lengua de las Mariposas" (*en Español*)

Manuel Rivas' short story "La lengua de las mariposas" heavily features the natural world, particularly as an element that cements the bond between Gorrión, the main character, and his teacher, who helps him explore the world in a new way. There are many lessons taught to Gorrión by way of using nature, but the story also presents lessons to the reader by using nature as a direct conduit for those messages. Many characters' roles have clear connections to nature such as Gorrión, whose name translates to sparrow, and the teacher, who is consistently referred to as resembling a toad. These comparisons allude to their places in the "natural order" of the society of a town in Galicia, Spain, during the months just before the Spanish Civil War officially begins.

I will analyze how these allusions affect the characters and how it shows their growth and development throughout the course of the story as well as how they react to the systemic understanding of their surroundings and how those same surroundings change them. The natural evolution of these characters depends on their individual choice and their evolution, or lack thereof, leads to a clear determination of the futures of the characters.

Rebecca Ritter, '18 **Chicago, IL**
Biochemistry & Molecular Biology *Tammy Mildenstein*

Extracting, Amplifying, and Sequencing Pteropodidae DNA from Excrement Samples

Flying foxes, large species of Pteropodidae, are regarded as an important family for forest maintenance and regeneration because they are considered "keystone" seed dispersers. Over 289 plant species are known to depend on pollination and seed dispersal by flying foxes, and 91% of dispersed seeds are handled by flying foxes. A range of ecological threats such as habitat loss and alteration, hunting, roost disturbance, severe storms, and introduced species have led to a dramatic drop in Pteropodidae population sizes. These threats not only affect flying fox populations, but the biodiversity and the sustainability of tropical and subtropical ecosystems as well.

The use of molecular techniques is invaluable to conservation biologists allowing for the collection of data on population connectivity, genetic diversity, and roosting ecology. However, DNA sampling methods such as trapping can pose great risk to the bats. Thus, non-invasive genetic sampling via fecal collection is a favorable method that avoids the over handling of a threatened and elusive animal species. We demonstrate the use of this sampling method on Pteropodidae as a non-invasive molecular technique used to identify species. Using fecal matter collected from an isolated population of flying foxes, *Pteropus hypomelanus*, roosting on the peninsula of Myeik, Myanmar, we describe the successful amplification, cloning, and sequencing of full-length cytochrome b (cytb) mitochondrial DNA as defined by the primers.

Hannah Robertson, '18 **Durango, CO**
English & Creative Writing *Michelle Mouton*

Eve: Reinterpreted

The seventeenth-century poet and writer John Milton is best known for his epic poem *Paradise Lost*, published in 1667. Since the poem's publication, many scholars and critics have examined Milton's depiction of Eve, debating whether he depicted her as a *femme fatale* or whether he was surprisingly forward-thinking for his time in giving her autonomy and self-awareness. In any case, since the publication of *Paradise Lost*, hundreds of poets have presented their own take on Eve and on her actions leading to the Fall of Humankind, many granting Eve more autonomy over her choices than Milton. Poets Lucy Anderton, Jane McVeigh, Tasima Nasrin, and Jennifer Michael Hecht each create an Eve that challenges Milton's. In different poetic forms, each poet offers an alternative to the Fall, suggesting that Eve's actions were of her own volition or even that she knew there would be consequences of eating the fruit and, in some cases, knew what those consequences may be.

My close reading of three poems -- "Eve's Sestina for Adam" by Anderton, "Eve, Falling" by McVeigh, "Eve, Oh Eve" by Nasrin, and "History" by Hecht -- will focus on the ways poetic diction and form create a new interpretation of this Biblical tale.

Shay Rule, '19
Geology and Environmental Studies

Pinedale, WY
Rhawn Denniston

Instrumental Records of Modern Flooding Events at Cave KNI-51, Australian Tropics

Oxygen isotopes in tropical stalagmites are commonly used to reconstruct past monsoon variability. Layers of mud contained within stalagmites can record cave flooding events, and the analysis of this material represents an important complement to isotope-based rainfall reconstructions. Each cave is unique and, therefore, must be characterized by its individual hydrological characteristics and boundary conditions.

We report the first two years of a four-year study of cave flooding in cave KNI-51, tropical Western Australia. Data loggers recorded barometric pressure/water level within a single room located 500 m from the entrance and adjacent to the area from which stalagmites containing numerous flood layers were collected. Monitors were installed at three different elevations, each separated vertically from the next by approximately two meters. The lowest logger is located in a depression marking the lowest point in the room while the middle logger is mounted against a flowstone ledge halfway to the ceiling and the highest logger is located just below the ceiling of the cave.

The last two years have been a study in contrasts of monsoon activity. The monsoon rains of 2015-16 were some of the driest on record, ranking 29th in the past 40 years. Meanwhile, the 2016-17 monsoon season was one of the wettest, ranking 7th in the past 40 years, with January 2017 the wettest ever recorded. In 2015-16, water levels rose to the point of submerging the bottom most logger only twice; no other water level increases were detected. However, 2016-17 recorded 17 floods, eight of which filled the cave completely. The rain required to completely flood the room is a function of prior moisture and rainfall intensity, although 75-100 mm of rainfall over 4-7 days represents the minimum intensity required for flooding. However, flooding appears tied to total rainfall occurring across the previous five days. On average, once water levels begin to rise, the room can fill to the ceiling within an hour and drain in less than three hours. Understanding how much rain needs to fall in order to flood the cave can provide a more accurate interpretation of past monsoon rains from stalagmites.

Christopher Ryerson, '18
Theatre

Aspen, CO
Janeve West

Neuro da Verse: Poetry for a Different Brain

"Neuro da verse: Poetry for a different Brain" is a Poetic Performance Essay- a prototype testing out my methodology for my future career in Advocation for Neurodiversity through the Arts. Neurodiversity is an umbrella term for the wide variety of ways a human can have a brain different than what their culture considered to be average in function or capability. I myself have ADHD, and my work in advocation stems from my experiences as a child struggling to understand the world and to be understood in return.

The performance I created celebrates the most powerful tool I have had throughout my quest to be understood: poetry. The project begins as a platform for myself and four other neurodiverse poets from Cornell to share personal narratives, poetic pieces that cover all the different ways poetry can and has helped overcome the difficulties of communicating neurodiversity. The performance then shifts to call the audience to action, using the stories of success through poetics as a rallying cry to encourage the writing and sharing of poetry in the neurodiverse community.

My methodology of advocation is built on the goal of giving the neurodiverse population opportunities to create art- art that is not only true to their own designs, but effective at reaching others at any given scale from the national to the interpersonal level. The agency that comes with being able to communicate in ways that can be understood and respected have directly benefited my life and the lives of my fellow poets who participated in this capstone performance.

In this lecture, I will be discussing the process I went through to generate and perform my capstone project, and the process of producing a collaborative performance that effectively facilitates the self-advocation and expression of the participants.

Elisabeth Sage, '19 **Denver, IA**
Abigail Cohen, '18 **Houston, TX**
Kendall Glennon, '18 **Chicago, IL**
Kaitlyn Alvarez, '19 **Morton, IL**
Sandra Gomez, '18
Gabby Carlson, '21
Psychology *Melinda Green*

Effect of a Dissonance-Based Eating Disorder Program on Cardiac and Psychological Risk Factors

Objective: We conducted a controlled randomized preliminary trial of an expanded online version of the *Body Project* (*n*=46) compared to an assessment-only control condition (*n*=36) via a longitudinal design (baseline, postintervention, 2-month follow-up) in a community sample of women (*n*=82) with clinical (*n*=53) and subclinical (*n*=29) eating disorder symptoms.

Method: The traditional content of the *Body Project* was modified to include verbal, written, and behavioral exercises designed to dissuade objectification and maladaptive social comparison and adapted to an online format. Body dissatisfaction, self-esteem, self-objectification, thin-ideal internalization, maladaptive social comparison, trait anxiety, positive affect, negative affect, and eating disorder symptomatology were evaluated in the control and the online expanded *Body Project* condition at baseline, postintervention, and 2-month follow-up.

Results: A 2 (condition: online, control) x 3 (time: baseline, postintervention, 2-month follow-up) mixed factorial multivariate analysis of variance (MANOVA) was conducted to examine statistically significant group differences. As predicted, results indicated a statistically significant condition x time interaction.

Conclusions: Participants in the expanded online *Body Project* condition showed significant reductions in body dissatisfaction, eating disorder symptoms, and associated psychological risk correlates from baseline to postintervention and follow-up; contrary to predictions, eating disorder symptoms or risk correlates were not significantly lower in the online dissonance condition compared to the waitlist control condition at postintervention or 2-month follow-up.

Jillian Schulte, '19 **Naperville, IL**
Ethnic Studies *Misha Quill*

EST Capstone: Interning at The Field Museum

Over the past few years, The Field Museum of Natural History has worked on an interdisciplinary research project that explores the various impacts of urban gardens in the ethnic neighborhoods of Chicago. Stemming from Actor-Network and Political Ecology Theory, a team of anthropologists, biologists, ethnobotanists, and professionals in medicine began to explore how gardeners and their networks contribute to the health and wellbeing of their surrounding community. This concept of wellbeing extends past nutrition and physical health, reaching to spheres of community support, networking, personal agency, and linkage to cultural identity. Through various methods of data collection (participant observation, field notes, interview transcripts, questionnaires, photo documentation, etc.), the research team hopes to reveal the vital role of these green spaces, as well as promote more research and public support for urban gardening.

For my Ethnic Studies Capstone course, I worked as an Integrative Research Center Intern under Dr. Alaka Wali, one of the leading heads of the urban gardening project. I was given the opportunity to work with and contribute to the collected data, ultimately gaining a greater understanding of factors which impact and reflect ethnic identity. Additionally, I partook in various other lectures, tours, and assignments with other researchers, which expanded both my personal knowledge of ethnic studies and familiarity with different realms in The Field Museum. The presentation serves to highlight my experience by outlining the key concepts of this research project, my role and responsibilities as an intern, and how the one-month internship has influenced my own professional direction.

Jillian Schulte, '19 **Naperville, IL**
Kinesiology and Anthropology *Christina Johnson*

The Development, Application, and Impacts of Person-Directed Care

For many North Americans, a common stigma exists against nursing homes and elder care services, aligned with fears of abandonment, loss of autonomy, and aging. Nursing homes have become depicted as feared, hospital-like facilities where the old, sick, and dying can gain medical intervention before death. This cultural conception feeds into the mindset that care must be medical, residents are patients, and the elderly are not equal members of society. In response to these stigmas of placement, various experimental nursing facilities sprung into existence in the 90s, pushing for a cultural shift in philosophy of caregiving. Person-Directed Care (PDC), one of these shift ideologies, is unique in that it stresses the importance of resident-staff relationships, goal setting, and freedom of resident choice/routine. Deemed a humanistic model of care, PDC heavily contrasts with traditionally-styled medical models which prioritize efficiency, consistency, and decision hierarchy over the voice of the resident.

During a 10-week internship at a rehabilitation center, I gained direct insight into the development, application, and perceived impacts of Person-Directed Care in a long term and hospice care setting. In this presentation, I explore the historical development of nursing facilities and care philosophies, a specific application of the PDC model, and the impacts PDC has on residents, families, and working staff members. These insights were compiled through research into existing literature, as well as my own observations while shadowing at the care facility. Additionally, this internship led me to gain a greater understanding of the United States' cultural perception of aging, nursing homes, medical intervention, resident autonomy, and Self-Determination Theory. Ultimately, this presentation aims to expose how care philosophies like PDC have the potential to combat the cultural assumptions and stigmas that come with end-of-life facilities as well as create paths for the expansion of patient-conscious ideologies of care.

Caitlin Stieber, '18
Biochemistry & Molecular Biology

Sterling Heights, MI
Craig Teague

Studying the Effects of Perivascular Adipose Tissue on Notch Signaling in Human Vascular Smooth Muscle Cells

Additional Authors: Joshua Boucher, Lucy Liaw

Perivascular adipose tissue (PVAT) is a fat depot that surrounds arteries. In healthy individuals, PVAT signals to the smooth muscle cells of the aorta to maintain the dilation and regular function of the vascular wall. In individuals with a metabolic disease, PVAT is inflamed, loses its vasoprotective effects, and can increase vascular plaque formation. While the effect of PVAT on smooth muscle cells is known, its specific effect on notch signaling in smooth muscle is not well understood. The notch-signaling pathway is important in cell proliferation. The goal of our research was to understand the effect of PVAT on the notch signaling pathway in vascular smooth muscle.

We found notch 1, 2, and 3 (receptors for the notch-signaling pathway) were downregulated at the gene level in human vascular smooth muscles cells (HVSMC) treated with PVAT concentrated media, but were unchanged at the protein level. The gene levels of downstream targets for notch signaling (Hes1, Hey1, Hey2) were downregulated in HVSMC treated with PVAT conditioned media. Additionally, Hes1 (smooth muscle marker) was confirmed to be downregulated at the protein level, suggesting notch signaling is downregulated in HVSMC treated with PVAT conditioned media. There were no apparent changes in cell proliferation in VSMC treated with PVAT conditioned media. PVAT down regulates VSMC notch signaling through intercellular signaling. These findings further our understanding of the molecular regulation of vascular function.

Caitlin Stieber, '18
Chemistry

Sterling Heights, MI
Craig Teague

Ionic Liquid Membranes and Adsorbents Derived from Carbonated Beverages for Gas Separations

Addition Author: Jennifer Schott, Zoe Mann, Craig Teague, Sheng Dai, and Shannon Mahurin

Concern about greenhouse gas emissions, particularly from factories, has driven the development of more efficient gas separation methods. The current methods of industrial gas separation use about 40% of generated energy just to regenerate the separation methods, which is not energy efficient. Our goal was to develop novel, efficient methods for separating carbon dioxide (CO2) from nitrogen gas (N2) using mesoporous carbon membranes containing ionic liquids (ILs) and adsorbents derived from carbonated beverages.

Ionic liquids are viscous liquids composed of a cation and anion that can be placed in porous carbon membranes and used to separate gases. We used two ILs: [P14, 6, 6, 6]+ [Cyano modified Pyrrolidinium] and [emim][BCN4], and an IL solution with 10% [P14, 6, 6, 6]+ [Cyano modified Pyrrolidinium] in [emim][BCN4]. We tested the permeabilities of CO2 and N2 through the membranes as a function of pressure, as well as how much CO2 passes through relative to N2 (selectivity). As pressure increased, the ability of both gases to pass through the membrane increased; membrane selectivity also increased with pressure. The 10% [P14, 6, 6, 6]+ [Cyano modified Pyrrolidinium] solution is more permeable than either of the ILs on their own, but it is less selective.

We also derived powdered adsorbents from four carbonated beverages (Coca-Cola®, Push Orange®, Diet Pepsi®, and Diet Mtn Dew®) and distilled water (30 mL). Adsorption is the process where the gas will adhere to the surface of the powder. The powder will ideally bind more of one gas than the other, thus separating the gases. We characterized the carbon powders through surface area and gas adsorption measurements, scanning and transmission electron microscopy, and energy dispersive x-ray spectroscopy. The powders adsorbed more CO2 than standard ordered mesoporous carbon, had moderately high selectivity values (~15), and high CO2 interaction energies (up to 29.2 kJ/mole). Interaction energy is the amount of energy it would take to separate the gas from the adsorbent. Most of the adsorbents had spherical particles, some of which were hollow; this morphology helps the powders adsorb more CO2 and is generally only seen with more complex syntheses. Our research developed two novel techniques to separate gas and reduce greenhouse gas emissions. While these methods are not yet ready for use in industry, they have the potential to be more energy efficient than current methods, thus improving energy efficiency.

Mary Tamo, '19 **Chicago, IL**
Libby Anderson, '18 **Spring Grove, IL**
Biochemistry & Molecular Biology *Craig Tepper*

Symbiosis in Marine Gastropods: What Are Photosynthetic Symbionts Doing in Shell-Bearing Snails?

Symbiodinium are photosynthetic algal protists that provide various physiological benefits to marine invertebrates that live in shallow tropical oceanic regions (Fournier, 2013). Symbiosis provides a benefit to both organisms. The algae converts light and CO2 into organic compounds that are beneficial to the host and the host provides protection and nutrition to the symbiont. Organisms that host symbionts harvest photosynthetic products released by algae at substantial rates (Yellowlees et al., 2008).

Most marine invertebrates that host photosynthetic symbionts are members of two phyla, Porifera (sponges) and Cnidaria (corals, sea anemones and jellyfish). Additionally, photosynthetic symbiosis has been documented in a few shelled molluscs (Venn et al., 2008). Examination of queen conch (*Strombus gigas*) indicates there are symbionts present within the cells of this snail during their translucent veliger (larval) development stage and in adult (Banaszak et al., 2013). The symbionts are photosynthetically active during the veliger stage but there is little evidence to indicate that the symbionts are photosynthetically active in adult tissue.

We are using intertidal marine nerite snails to address two main questions: 1) Are *Symbiodinium* present within nerite cells and 2) Are the symbionts expressing photosynthetic-specific genes? Our preliminary data indicates that nerites contain *Symbiodinium* (N=36) and that theses symbionts are expressing the photosynthetic-specific genes psa-A and psb-A. Psa-A encodes for P700, a protein in photosystem I and psb-A encodes for D1, an integral protein in photosystem II (McGinley et al., 2012). Our long-term goals include determining if the symbionts are providing photosynthetic nutrients to adult nerites.

Carlos Tellez, '18
Geology

Griffith, IN
Emily Walsh

Reconstruction of the P-T Path of Metapelites in the Harcuvar Core Complex, NW Arizona

The Harcuvar Mountains, NW Arizona, are located within the active extensional zone of the Basin and Range province. During tectonic extension, the middle to lower crust of the Harcuvars was exhumed along a low-angle fault and exposed at the surface, creating a metamorphic core complex. Other, similar, metamorphic core complexes exist to the north and south, along the North American cordillera. Researchers first believed that these metamorphic core complexes were created during one tectonic event in the late Miocene (23 to 5 mya), but new research suggests an earlier significant tectonic event happened in the Early Cretaceous (145 to 100 mya) (Bryant et.al., 2008).

We studied Perple_x and Theriak-Domino, two different computer programs with a built-in thermodynamic database, to analyze two samples (Har77 and Har92) from the Harcuvar metamorphic core complex. In particular, we wished to: 1) establish the depths from which the rocks originated; 2) determine the pressure – temperature paths of the samples through the earth; and 3) resolve whether the metamorphic core complex formed in one or two main stages. Perple_X uses bulk rock composition to calculate a sample-specific equilibrium assemblage diagram, pseudosection, which shows the stable mineral assemblage for that sample over a range of pressure and temperatures. Results for Har77 suggest that the sample is a lower crustal rock, originating at depths of at least 35 (~10.5 kb); however, most high-pressure information has been lost from the rock. Rim compositions imply that the rock was exhumed to the middle crust (~12 km deep) by the Early Cretaceous. Har92 reveals only lower-middle crustal (~20) pressures, but at much higher temperatures (>800 °C), also during the Early Cretaceous. Evidence from garnet zonation indicates that the main exhumation of these rocks to the middle crust occurred during the Early Cretaceous, implying a two-stage formation history for the Harcuvar metamorphic complex.

Gus Turyn, '18
Philosophy

New York City, NY
James White

Metaethics

For student symposium, I would like to present my honors thesis on metaethics. Metaethical inquiry goes in a number of directions. In this paper, I address some of the main themes across areas of metaethics and discuss one in particular: the question of moral motivation. In order to address this question, I will discuss three criteria I consider central to metaethics. The first is application to everyday moral discourse. A theory must make sense of the way in which we typically use moral language. A theory that addresses larger-scale questions of ethics but does not explain why individuals tend to commit actions that they themselves would categorize as immoral leaves something out of the picture of ethics. The second is ethical realism--the question of whether or not ethical claims make assertions about mind-independent truths and, if they do, whether or not those truths refer to natural phenomena. The third, cognitivism, asks the question of whether ethical utterances make meaningful claims about the world or simply express personal approval and disapproval of the actions in question. Any theory that fails to answer questions of realism or cognitivism leaves out a significant portion of the metaethical debate. In this paper, I will argue that a theory that fails to make sense in light of these three criteria fails as a whole metaethical theory.

I will do this by summarizing and discussing a number of metaethical theories, starting with John Mackie's Error Theory and AJ Ayer's Expressivism, then moving into Simon Blackburn's quasi-realism. I will defend quasi-realism throughout the paper. My central argument will be that quasi-realism does a better job than motivational internalism or motivational externalism at explaining moral motivation. In arguing this, I will also argue that quasi-realism not only addresses the questions of moral realism and cognitivism, but answers them more sufficiently than any other metaethical theory, several of which I will compare to quasi-realism.

Cynthia Valenzuela, '18
Music

Aurora, CO
Aaron Perrine

Minimalism: Pop Music for Intellectuals

Minimalism in music is defined by its repetitive figures, sustained tones, subtle variations, and stasis. This genre began in the 1960s as a reaction to the European serialist movement. While the two genres—minimalism and serialism—have wildly different sounds, they do share some commonalities: an emphasis of process over product. In other words, the majority of the decisions are made during the pre-compositional stage (process), and are then allowed to simply run their course (product).

By looking at important minimalist composers such as Le Monte Young, Terry Riley, Steve Reich, and Philip Glass, we will see their work not only embodies this concept of "process over product," but that it is also influenced by other genres of music such as rock, jazz, and the musical avant garde. Although minimalism was sometimes criticized, and notably labeled as "pop music for intellectuals" by Samuel Lipman, this experimental form of music developed into an important genre that has influenced today's pop culture in music and film. Popular artists like Bon Iver, Sean Carey, and James Blake show aspects of minimalism such as repetitive musical patterns, sparse instrumentation, and stasis. In this presentation, I will discuss the definition of minimalism, its trajectory, and how it has influenced today's contemporary pop music.

Stephanie Voller, '19
Cali Pfleger, '20
Environmental Studies

Marengo, IL
Milwaukee, WI
Rhawn Denniston

Comparing Trace Element Ratios with Isotope Ratios in Tropical Australian Stalagmites

Tropical stalagmites can serve as proxy records of precipitation through their oxygen-18/oxygen-16 isotope ratios ($\delta^{18}O$), and can be accurately dated using uranium-thorium methods. Rainwaters in many tropical areas have $\delta^{18}O$ levels that are driven by the "amount effect" in which higher amounts of rainfall are generally depleted in $\delta^{18}O$. Stalagmites incorporate the oxygen from rainwater which means that stalagmite $\delta^{18}O$ is reflective of rainwater $\delta^{18}O$ and, thus, the intensity of rainfall through time. Stalagmites also contain carbon isotopes ($\delta^{13}C$) which reflect the amount or type of vegetation present, or secondary processes occurring in the rock above the cave, and by using this record one can link rainfall and vegetation/hydroclimate over time. Recent studies have shown a correspondence between trace metal (primarily Mg and Sr) abundances and $\delta^{13}C$. Each isotope or trace element ratio has its own bias and may be influenced in ways that either reflect or are independent from climate, and it is important to use a variety of climate reconstruction methods to account for these biases.

This study analyzed Mg and Sr in sixteen different stalagmites from KNI-51, a cave located in the monsoon region of the north-central Australian tropics. The stalagmites were previously dated to 300-2900 years ago and were analyzed for $\delta^{18}O$ and $\delta^{13}C$ values. Trends in and relationships between Mg/Ca, Sr/Ca, $\delta^{18}O$, and $\delta^{13}C$ were examined.

We found that Mg/Ca ratios tend to be correlated with both $\delta^{18}O$ and $\delta^{13}C$. Sr/Ca ratios, on the other hand, do not exhibit a strong relationship with either $\delta^{18}O$ or $\delta^{13}C$. Both collective and individual stalagmite data have confirmed these trends. We interpret these findings to suggest that Mg/Ca ratios are more closely linked to past changes in rainfall and vegetation at this site.

Past research suggests that Sr/Ca and Mg/Ca ratios in stalagmites can reflect a variety of mechanisms including stalagmite growth rate and crystallization of calcite in voids above the cave, which, in turn, are controlled by changes in rainfall. Sr/Ca variations due to growth kinetics alone require extremely large changes in speleothem growth rates. The differences between Mg and Sr thus remain unclear but may reflect hydroclimatic variability.

Brittany Wellman, '19 **Paola, KS**
Russian *Lynne Ikach*

Translating Russian: A Student's Perspective

In order to grow as a non-native speaker of a foreign language, one must be exposed to natural and increasingly complicated use of the language. There are plenty of simple phrases and stories for the new learner and, once one becomes sufficiently advanced, news articles and tv shows are a wonderful way to increase comprehension, but the intermediate learner is left stranded. Phrases are too simple to teach them anything new and news articles can be dauntingly challenging for a student with limited vocabulary. In my presentation, I address the ways intermediate learners can bridge the gap to more challenging articles without becoming lost in vocabulary and sentence structures that they haven't previously encountered.

Benjamin Kit Wong, '18 **Fremont, CA**
Theatre *Caroline Price*

Our Stories: A Showcase of Student Narratives

When you have a diverse community that is still fractured, what do you do? What do you need? Community and connection. *Our Stories* was an attempt to take a world that was so strongly divided and bring together a group of people to connect and share. To talk about themselves and to listen to each other.

The beauty of Cornell is the block plan; for one month we study one thing really closely. We live in that class, that world. And then we are done, and just as quickly as it started, it's over and a new class becomes our lives. We disconnect completely from friends we may have made in one class and connect or reconnect to new ones. As an artist and as a guiding collaborator, I wanted to challenge this set-up, and use the extended rehearsal process I am familiar with in the world of theatre to encourage a community of people to come together. For three months (September 2017-November 2017), this group of ensemble members would write whenever they had time, and would come together to share, and then spend whatever time we had left doing something to build bonds or share a common knowledge. Through the process of free-writing, drafting, and narrative experimentation, 15 ensemble members generated stories to share in a showcase. In September 2017, 15 people from a variety of backgrounds and departments of study walked into the audition room alone. In November, they walked out of the Van Etten-Lacey House as a community, validated and supported in the fact that they had stories to tell and people to share them with.

This presentation will present the project, along with the process that we went through, and how as the director/guiding collaborator, I used a combination of theatre games and discussion of social justice to create a safe space for exploration, discussion, and expression, where people who were unfamiliar with each other were more comfortable sharing things they normally would not feel encouraged to--stories about marginalization, about depression, about small triumphs, and about growing older. Kate Gielas, one of the ensemble members, will present the piece she wrote for the showcase, titled "Fiery Determination."

Brian Wyzgowski, '18 **Port Huron, MI**
Art & Art History *Christina Penn-Goetsch*

A Forgotten Symbol of Florence: Donatello's *Penitent Mary Magdalene*

Donatello's *Penitent Mary Magdalene*'s emaciated wooden sculpture stands almost six feet tall. Her once-gilded hair covers a body that otherwise seems nothing more than a skeleton stretched with weathered skin. Such a state first led scholars like John Pope-Hennessy to claim that the figure's execution results from some sort moral crisis. Yet the only primary sources concerning the *Magdalene* are in a document of October 30, 1500 and Giorgio Vasari's account from 1550. These undetailed references explain nothing of the *Magdalene*'s origins or her eventual purpose. They merely identify Donatello as the artist and that the *Magdalene* was placed in the Baptistery of Florence's Duomo by 1500. This baptistery was critical to Florentine identity. In order to become a citizen, one needed to be baptized in this specific location. The location, at this time, is important to understanding the sculpture's history.

One relevant secondary source on Donatello's penitent figure can be found in Deborah Strom's examination from 1980, "A New Chronology for Donatello's Wooden Sculpture." The article changes the date of its creation from 1453 to at least 1443. To learn more, one must also build on Martha Levine Dunkelman's work, "Donatello's Mary Magdalen: A Model of Courage and Survival" of 2006. She argues that Donatello's *Magdalene* was not just an emaciated representation of extreme penitence, but also an inspirational symbol for repentant prostitutes. Furthermore, Dunkelman offers the possibility that the Cistercian convent of Maddalena di Cestello was the sculpture's likely place of origin. Building on the work of Strom and Dunkelman, I will consider the social, religious, and political contexts to demonstrate why Donatello's penitent *Magdalene* was moved to such a prestigious location as a new symbol of Florence, at the direction of its Bishop St. Antoninus, in response to the city's zeitgeist of perceived moral decay.

Stephanie Xavier, '18 **Aurora, CO**
Melissa Orton, '18 **Downers Grove, IL**
Kinesiology *Kristin Meyer*

Core Strength and Frontal Plane Projection Angle in Relation to Incidence of Injury

We conducted a study evaluating the relationship between core strength and frontal plane projection angle during single leg squats and injury rates. The participants included 47 student athletes who participated in NCAA DIII soccer, basketball, and volleyball during the 2017-2018 season. We hypothesized that the participants who had greater core strength would endure fewer injuries to the body below the bottom of the sternum over the course of the season. The second hypothesis was that participants who had a greater frontal plane projection angle during a single leg squat would show a higher incidence of injury. Core strength was measured using five different tests, and frontal plane projection angle was evaluated using pictures taken during a 45-degree single leg squat and CorrelDraw, an editing software. The injury information was collected from the Certified Athletic Trainer assigned to the participants' respective teams. There were no statistically significant relationships between core strength, frontal plane projection angle, and injury rates. Although the results did not support our hypotheses, further data collection could lead to better results and better insights into the relationships between all of these factors.

Cole Zrinsky, '18
Geology

Appleton, WI
Rhawn Denniston

Influence of the Samalas Volcanic Eruption of 1257 on Equatorial Monsoon Patterns in Northern Australia

The Asian Australian Summer Monsoon is a natural cycle of rainfall responsible for the wet and dry seasons of tropical Australia. This cycle is controlled by the position of the Intertropical Convergence Zone (ITCZ), which shifts due to a multitude of drivers ultimately influencing the difference of sea surface temperatures between the Northern and Southern Hemispheres. In order to better understand the trends and causes of monsoon variability, oxygen isotopes of stalagmites can be utilized to track amount effects of tropical precipitation in which the lighter oxygen isotope is favored under more intense rainfall conditions. Volcanic eruptions have been shown to impact monsoon rainfall patterns over short (1-5 years) time scales. Of particular importance are eruptions characterized by high levels of explosivity, as ejecta composed of sulfur dioxide prevent sunlight from reaching Earth's surface, leading to global cooling. The largest eruption of the past 2000 years was the CE 1257 event at Mt. Samalas, southern Indonesia, which erupted an estimated 257,900 kg of sulfur into the atmosphere. Mt. Samalas is located only 1,530 km from cave KNI-51 in the central Australian tropics, and stalagmites from KNI-51 have been used to reconstruct Australian monsoon variations over the past several millennia. The goal of this research was to investigate the Australian monsoon response to the CE 1257 Mt. Samalas eruption as recorded by KNI-51 stalagmites.

Two stalagmites from KNI-51 (KNI-51-F, KNI-51-16-4) have been previously dated by uranium-thorium methods and shown to have grown across the time of this eruption. These two stalagmites were micromilled at intervals correlating to approximately 3 months/sample, and the oxygen isotopic ratios of the resulting powders were measured using mass spectrometry at the Iowa State University stable isotope laboratory. In KNI-51-F, the year CE 1257 occurred during a time of generally higher rainfall, but no pronounced isotopic anomaly – either positive or negative – was identified in this record. Similarly, KNI-51-16-4 suggests that CE 1257 appeared to be a time of moderate to high rainfall, but no isotopic peaks were observed. The two records were not identical; in general, the variance of oxygen isotope ratios was much higher in KNI-15-4 than in KNI-51-F.

Analysis of high resolution climate models suggest that the Australian monsoon has been highly sensitive to volcanic activity over the past millennium. However, neither stalagmite recorded any severe variation in monsoon activity at or near CE 1257. One possible explanation for this discrepancy is that dating errors were large enough that the eruption was not actually within the bounds of our samples. However, this is unlikely based on the precision of the uranium-thorium dates. Another possibility is that rainfall from the area varied independently of volcanic forcing, which is feasible, particularly if the eruption plume traveled northwest from Samalas, causing the eruption to affect the Northern Hemisphere much more than the Southern Hemisphere. Evidence of an extremely cold CE 1258 in Europe supports this model. Finally, the absence of a spike in rainfall amounts around the time of the eruption could mean that Australian monsoon activity was shut down completely for the years following the eruption causing no rainfall to be recorded within the stalagmite record.

Cornell College Student Symposium

Inaugurated in the spring of 1997, the Cornell College Student Symposium provides an annual opportunity for undergraduate students on the Hilltop to share the fruits of their study in a forum that encourages wide community participation and attendance. Students who have done interesting and accomplished work in the setting of regular term courses or in independent research may be invited to present by faculty members or may themselves seek faculty sponsorship. Over a period of weeks beginning in the late fall, and with the assistance of their faculty sponsors, students indicate their intention to present, prepare a brief abstract of their work for inclusion in the Symposium program, and formulate the presentations themselves. The event, coordinated by the Center for Teaching & Learning, occurs in April each year.

The Symposium features three modes of presentation. One is an oral presentation of 15 minutes summarizing the project and its findings before a seated audience. Another is a poster presentation offering a graphic representation of the project along with explanatory comments made for the benefit of an audience circulating among the various poster displays. A third mode is the performance/lecture, particularly tailored to the fine arts. All of the presentations are made in concurrent sessions, some organized by mode of presentation, others by topical theme.

For presenters, the Symposium offers a prime setting for refining ideas, sharpening skills, and receiving feedback from the campus community, including students and faculty members in and beyond the presenters' major programs. For attendees, the Symposium offers a rich sampling of liberal arts research, represented by the work of dozens of students, in every academic division. For the College, the Symposium offers a memorable enactment of academic community, the contemporary realization of a historic ideal.

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