

# Forward from Dean Joe Dieker

Forward from Dean R. Joseph Dieker:

Welcome to Cornell College's 20<sup>th</sup> 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 90 students, working with 40 faculty members across 21 different departments and programs. There will be 38 oral presentations, 1 performance, 32 printed poster presentations, and 3 electronic poster presentations. The following pages present the schedule for the 2016 Student Symposium at Cornell College, along with the abstracts of the oral, performance, 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. Psychology is paired with International Relations. Philosophy presents with Environmental Studies. Biology is paired with Theatre. At Cornell College, students draw meaning and gain a richer sense of knowledge through the connections made across disciplines and subjects. Today is a day to celebrate this breadth of knowledge.

This year's symposium was coordinated by the Center for Teaching & Learning and the faculty of the Student Symposium committee: John Gruber-Miller (Classics), Kirilka Stavreva (English), and Emily Walsh (Geology). The logistics and technical aspects of the symposium were handled by Brooke Bergantzel, Greg Cotton, Laura Farmer, Amy Gullen, Jessica Johanningmeier, Kristin Reimann, Gabriella Torres, Paul Waelchli, Ellen Wrede, 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 I  
9:00 - 10:15

**DURHAM:**

Readers at Work: Responses and Revisions

**HALL-PERRINE EAST:**

Computing, Creating, and Culturing Chemical Interactions

**HEDGES:**

Lost and Found: Recovering Artistic Traditions

**MLK:**

Class, Gender, and Ethnicity in Musical Traditions

**RUSSELL:**

21st Century Fish: Invasive Species  
Drugs and Climate Change

**DURHAM:**

Reimagining the Visual

**HALL-PERRINE EAST:**

Data to the Rescue: Misdiagnosis and Prognosis

**HEDGES:**

Spiritual Insights into Underexamined Works of Art

**MLK:**

Patterns in Time: Beach Dynamics and Garnet Growth

**RUSSELL:**

Sound Waves, Sea Waves, and the Complexity of Gravity

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Session II  
10:45 - 12:00

# OVERVIEW



**THE ORANGE CARPET:**  
Morning Posters



**THE ORANGE CARPET:**  
Afternoon Posters

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- DURHAM:**  
Feeling Under Threat: Russia and the United States
- HALL-PERRINE EAST:**  
Ethical and Scientific Approaches to the Environment
- HEDGES:**  
Creative Dynamics in Theater-Making
- MLK:**  
Re-Reading Familiar Narratives: The Pleasures of Subversion
- RUSSELL:**  
Causes and Remedies for Social and Psychological Disorders

# SCHEDULE

## Oral Symposium Sessions

### Morning Session One 9am - 10:15am

#### Readers at Work: Responses and Revisions

Durham Room | Moderated by Michelle Mouton

- **Another Man's Ear: Reimagining Carver's Soundscape in Robert Altman's *Short Cuts***  
*English & Creative Writing*  
Author: Michael Spencer  
Sponsor: Michelle Mouton
- **Reading Between the Lines: Decoding the Annotator in Early Modern English Marginalia**  
*Medieval & Early Modern Studies*  
Author: Laura Michelson  
Sponsor: Michelle Herder
- **Literal Meaning and Literary Meaning: A Study on the Translations of John 3:16**  
*English & Creative Writing*  
Authors: Laurel Fraser  
Sponsor: Michelle Mouton

#### Computing, Creating, and Culturing Chemical Interactions

Hall-Perrine East Room | Moderated by Cynthia Strong

- **Computational Study of Interactions between CO<sup>2</sup> and Free Anions**  
*Chemistry*  
Author: Timothy Pavlik  
Sponsor: Craig Teague
- **A Study of Solution-Processed Porous Alumina Films**  
*Chemistry*  
Author: Yolanda Jones  
Sponsor: Craig Teague
- **Dependence of TOR-ts Phenotype on Solid Medium**  
*Biochemistry & Molecular Biology*  
Authors: Bethany King, Nguyet Minh Hoang, & Thao Luu  
Sponsor: Jeffrey Cardon

#### Lost and Found: Recovering Artistic Traditions

Hedges Conference Room | Moderated by Greg Cotton

- ***La Plena*: Rafael Tufiño and the Cultural Revival of Puerto Rico**  
*Art History*  
Author: Kristal Viera  
Sponsor: Christina Penn-Goetsch

# OVERVIEW

## Oral Symposium Sessions

### Morning Session One 9am - 10:15am

**Redefining Art History: Making and Printing 3D Digital Models of Ancient Tombs from Mexico**

*Art History*

Author: Arturo Hernandez

Sponsor: Ellen Hoobler

**Evolution of the European Dome**

*Classics*

Author: Johnathon Hilliard

Sponsor: John Gruber-Miller

### **Class, Gender, and Ethnicity in Musical Traditions**

Martin Luther King, Jr Room | Moderated by James Martin

**Beethoven's *Fidelio*: An Opera in Search of Class**

*Music*

Author: Eleanor Backman

Sponsor: James Martin

**Divine Divas: Feminist Studies of Operatic Females**

*Music*

Author: Emily Wenzel

Sponsor: James Martin

**The Sound of the Desert: Experiences with Music in the Middle East**

*International Relations/Middle Eastern Studies*

Author: Grayce McGregor

Sponsor: Steven Sacks

### **21st Century Fish: Invasive Species, Drugs, and Climate Change**

Russell Room | Moderated by Brian Nowak-Thompson

**Invasive Lionfish Management in Belize**

*Environmental Studies*

Author: April Richards

Sponsor: Andy McCollum

**The Effect of Acetamidophenol on Betta Fish**

*Biology*

Authors: David DeMoss, Aidan Litt, Anya Nguyen, & Isabella Blackburn

Sponsor: Tammy Mildenstein

***Betta splendens* Aggressiveness in Variations of Water Temperature**

*Biology*

Authors: Belou Quimby, Mari Dettweiler, Julia Eastham, & Camden Grundeman

Sponsor: Tammy Mildenstein

# SCHEDULE

## Oral Symposium Sessions

### Morning Session Two 10:45am - Noon

#### Reimagining the Visual

Durham Room | Moderated by Lynne Ikach

- **An Awkward Silence: Classic Avant-Garde Film Techniques Re-Explored**  
*English & Creative Writing*  
Author: Fin Boadu  
Sponsor: Leslie Hankins
- **Shadows of the Outer Worlds: A Transformation of *Dead Souls* from Verbal to Pictorial Art**  
*Russian*  
Author: Kayla Morton  
Sponsor: Lynne Ikach

#### Data to the Rescue: Misdiagnosis and Prognosis

Hall Perrine-East Room | Moderated by Aaron Miller

- **Identifying Diagnostic Errors in Healthcare Using Data Analysis**  
*Economics & Business*  
Authors: Anh Pham & Polina Durneva  
Sponsor: Aaron Miller
- **Elasticity of Household's Demand for Distributed Solar Energy in Southern California**  
*Economics & Business*  
Author: Linh Nguyen  
Sponsor: Todd Knoop
- **Diagnostic Errors in Pulmonary Embolism**  
*Economics & Business*  
Authors: Aeint Thet Ngon, Dawit Tsigie, & Jacob Cuellar  
Sponsor: Aaron Miller

#### Spiritual Insights into Underexamined Works of Art

Hedges Conference Room | Moderated by Greg Cotton

- **Saint Philomena as Delaroche's *Young Christian Martyr***  
*Art History*  
Author: Selena Erdman  
Sponsor: Christina Penn-Goetsch
- **Robert Fludd's *Mirror of the Whole of Nature and the Image of Art***  
*Art History*  
Author: Bryanna Thompson  
Sponsor: Christina Penn-Goetsch

# OVERVIEW

## Oral Symposium Sessions

### Morning Session Two 10:45am - Noon

**Early Modern Perceptions of the *Borghese Sleeping Hermaphroditus*** □

*Art History*

Author: Hannah Bostwick

Sponsor: Christina Penn-Goetsch

### **Patterns in Time: Beach Dynamics and Garnet Growth**

Martin Luther King, Jr Room | Moderated by Emily Walsh

**17 Years on a Beach: A Comparative Study of Beach Dynamics over Time** □

*Geology*

Author: Elena Skosey-LaLonde

Sponsor: Benjamin Greenstein

**Corrected Trace Element Data from UHP Garnets of the Tso Morari Complex,  
Ladakh Province, NW India: Evidence for Diffusion-Limited Uptake** □

*Geology*

Author: Anne Zegers

Sponsor: Emily Walsh

### **Sound Waves, Sea Waves, and the Complexity of Gravity**

Russell Room | Moderated by Ross Sowell

**The Three-Body Problem** □

*Mathematics & Statistics*

Authors: Kean Johansen & Ngoc Nguyen

Sponsor: Tyler Skorczewski

**Acoustic Levitation** □

*Physics*

Authors: Mason Chow, Phyo Lin, & Chris Gonzales

Sponsor: Derin Sherman

**Inexpensive Sea Temperature and Wave Energy Studies** □

*Computer Science*

Author: Cameron Seebach

Sponsor: Ross Sowell

# Oral Symposium Sessions

## Afternoon Session 1:30pm - 2:45pm

### Feeling Under Threat: Russia and the United States

Durham Room | Moderated by Tyler Carrington

- ❑ **The Cornered Bear: Analysis of the Justifications behind Putin's Aggressive Foreign Policy**  
*International Relations/Russian Studies*  
Author: Jared Rowe  
Sponsors: Robert Givens & Lynne Ikach
- ❑ **Name Change: The Story of Berlin, Iowa and German-Americans in World War One**  
*German*  
Author: Brian Gilg  
Sponsor: Tyler Carrington

### Ethical and Scientific Approaches to the Environment

Hall Perrine-East Room | Moderated by Jim White

- ❑ **Exploring Pragmatic Environmental Ethics in the Amazon Rainforest**  
*Philosophy*  
Author: Bailey Robb  
Sponsor: Jim White
- ❑ **Analysis of a Five-Million-Year-Old Coral Suggests Modern-Style El Niño Activity**  
*Geology*  
Author: Thomas Weiss  
Sponsor: Rhawn Denniston
- ❑ **An Analysis of Population Monitoring Methods: Creating a Standardized Counting Method for Southeast Asian Fruit Bats**  
*Environmental Studies*  
Author: Alexandra Young  
Sponsor: Tammy Mildenstein

### Creative Dynamics in Theater-Making

Hedges Conference Room | Moderated by John Gruber-Miller

- ❑ **Hear Me Roar: Using Devised Theatre to Amplify the Voice of a Community**  
*Theatre*  
Author: Jay Epps  
Sponsor: Janeve West
- ❑ **Kinship Dynamics in the War of Gothic Aggression**  
*Theatre*  
Author: Fin Boadu  
Sponsor: Jim VanValen

# OVERVIEW

## Oral Symposium Sessions

Afternoon Session 1:30pm - 2:45pm

**Managing the Fantastic**

*Theatre*

Author: Donna Warfield

Sponsor: Scott Olinger

### **Re-Reading Familiar Narratives: The Pleasures of Subversion**

Martin Luther King, Jr Room | Moderated by Kirilka Stavreva

**The Speed of Modernity in Harold Lloyd's *Safety Last* (1923)**

*English & Creative Writing*

Author: Abyssinia Moges

Sponsor: Kirilka Stavreva

**Satan in Hell**

*English & Creative Writing*

Author: Waldyn Benbenek

Sponsor: Michelle Mouton

**Between the Lines: What Can We Gain from a Queer Reading of *Anne of Green Gables*?**

*English & Creative Writing*

Author: Maria Catherino

Sponsor: Shannon Reed

### **Causes and Remedies for Social and Psychological Disorders**

Russell Room | Moderated by Suzette Astley

**Exploring Gender Violence and Women Empowerment in Bangladesh during the Post-**

**Millennium Development Goals Era**

*International Relations*

Author: Neelema Ahmed

Sponsor: A'amer Farooqi

**Effect of a Dissonance-Based Eating Disorder Program on Cardiac Risk Indices,**

**Objectification, and Maladaptive Social Comparison**

*Psychology*

Authors: Meghan Powers, Ruby Linkhart, Shuhan Reyes,

Sol Wooten, Wyatt Whitegoat, & Brianna Bryant

Sponsor: Melinda Green

**The Influence of the Hypothalamic-Pituitary-Adrenal Axis on the Development of Psychosis**

*Psychology*

Author: Ashley Brodell

Sponsor: Melinda Green

# Poster Symposium Sessions

## Morning Session 10:00am - 11:30am

- 1a Active vs. Nutritional Vitamin D Supplementation for Patients with Stage IIIB to IV Chronic Kidney Disease and its Effect on Inflammatory Protein Response and Risk of Cardiovascular Disease**  
*Biochemistry and Molecular Biology*  
Author: Sarah Calhoun  
Sponsor: Craig Tepper
- 2a The Effects of Diminished Proprioception on Cerebellar Development in ErbB2 Knockout Mice**  
*Psychology*  
Author: Ashley Brodell  
Sponsor: Sue Astley  
Sponsor: Craig Tepper
- 3a A Detailed Chemical and Microscopic Investigation of an Ice Age Stalagmite from Lehman Caves, Nevada**  
*Geology*  
Author: Christopher Felt  
Sponsor: Rhawn Denniston
- 4a Using Bioinformatics to Identify Immune System Genes in True Fruit Flies: A Step Towards Preliminary Probe Design**  
*Biology*  
Author: Becca Lensing  
Sponsor: Marty Condon
- 5a Stalagmite Records of Climate Change Spanning the Last 500,000 Years from Cape Range, Western Australia**  
*Geology*  
Author: James Garrett  
Sponsor: Rhawn Denniston
- 6a ETV5, an Ets Family Transcription Factor, is a Marker for RAS-Dependent Papillary Thyroid Cancer**  
*Biochemistry and Molecular Biology*  
Author: Nguyet-Minh Hoang  
Sponsor: Barbara Christie-Pope
- 7a Development of a High-Throughput Catalase Assay to Test Botanical-based Peptides**  
*Biology*  
Author: Clint McDaniel  
Sponsor: Barbara Christie-Pope
- 8a A Two Dimensional Study of Fish Benthic Feeding with Suction**  
*Mathematics and Statistics*  
Author: Joshua Lee  
Sponsor: Tyler Skorczewski

# OVERVIEW

## Poster Symposium Sessions

### Morning Session 10:00am - 11:30am

- Macro-Fungi Diversity Survey of Primary, Secondary, and Coastal Forest on the OSA Peninsula** 9a  
*Biology*  
Author: Grace Leppink  
Sponsor: Andy McCollum
- The Effectiveness of Human-Resource Focused Charities in a Market with Government Labor-Training Alternatives** 10a  
*Politics & Economics*  
Author: Katelynn Raney  
Sponsor: David Yamanishi
- Parkinson's Disease and Melanoma: Using Zebrafish to Explore the Roles of Ion Channel TRPM7 in Dopamine Neurons and Melanocytes** 11a  
*Biology*  
Author: Shashanna Moll  
Sponsor: Barbara Christie-Pope
- Systematic Characterization of Cholesterol in Planar Lipid Bilayers by Single-Molecule Studies** 12a  
*Chemistry*  
Author: Sydney Strunk  
Sponsor: Jai Shanata
- Examining the Symbioses between Millepora and Symbiodinium at Two Thermally Different Locations** 13a  
*Biology*  
Author: Allison Samayoa  
Sponsor: Craig Tepper
- Motion of a Ball on a Spinning Saddle** 14a  
*Physics*  
Author: Laura Wetzel  
Sponsor: Derin Sherman
- Discovering Patterns of Diversity** 15a  
*Biology*  
Authors: Julia Thome, Bryan Hernandez  
Sponsor: Marty Condon
- Elemental Zoning Analyses in Eclogitic Garnets from the North Qaidam UHP Metamorphic Belt: Testing Trace Element Zoning Models and P/T Path** 16a  
*Geology*  
Author: Sean Quick  
Sponsor: Emily Walsh

# Poster Symposium Sessions

## Afternoon Session 1:00pm - 2:30pm

- 1b Monarch Prevalence and the Survival Rate between Egg and Larvae Stages of Monarch Development**  
*Biology*  
Authors: Libby Anderson & Jennifer Davis  
Sponsor: Tammy Mildenstein
- 2b Systematic Characterization of Resveratrol in Planar Lipid Bilayers by Single-Molecule Studies**  
*Chemistry*  
Authors: Madeleine Ball & MariKate Murphy  
Sponsor: Jai Shanata
- 3b The Role of Personality in Sustained Attention and Response Inhibition**  
*Psychology*  
Author: Andrew Crow  
Sponsor: Alice Ganzel
- 4b Computational Model of Tumor Angiogenesis**  
*Mathematics*  
Authors: Mason Chow & Lainey Drevlow  
Sponsor: Tyler Skorczewski
- 5b Building Resonance**  
*Physics*  
Authors: Raisa Ebner & Jake Lehman  
Sponsor: Derin Sherman
- 6b Hydrological Response to an Increasingly Warm Volga Region**  
*Geology*  
Author: Stefano Garcia Riefkohl  
Sponsor: Jonathan Baker
- 7b The Difficulties of Translation**  
*Russian*  
Author: Shannon Ehrnstein  
Sponsor: Lynne Ikach
- 8b Marketing, Distribution, and Sustainability in the Food System**  
*Environmental Studies*  
Author: Fiona Flynn  
Sponsor: Amer Farooqi

# OVERVIEW

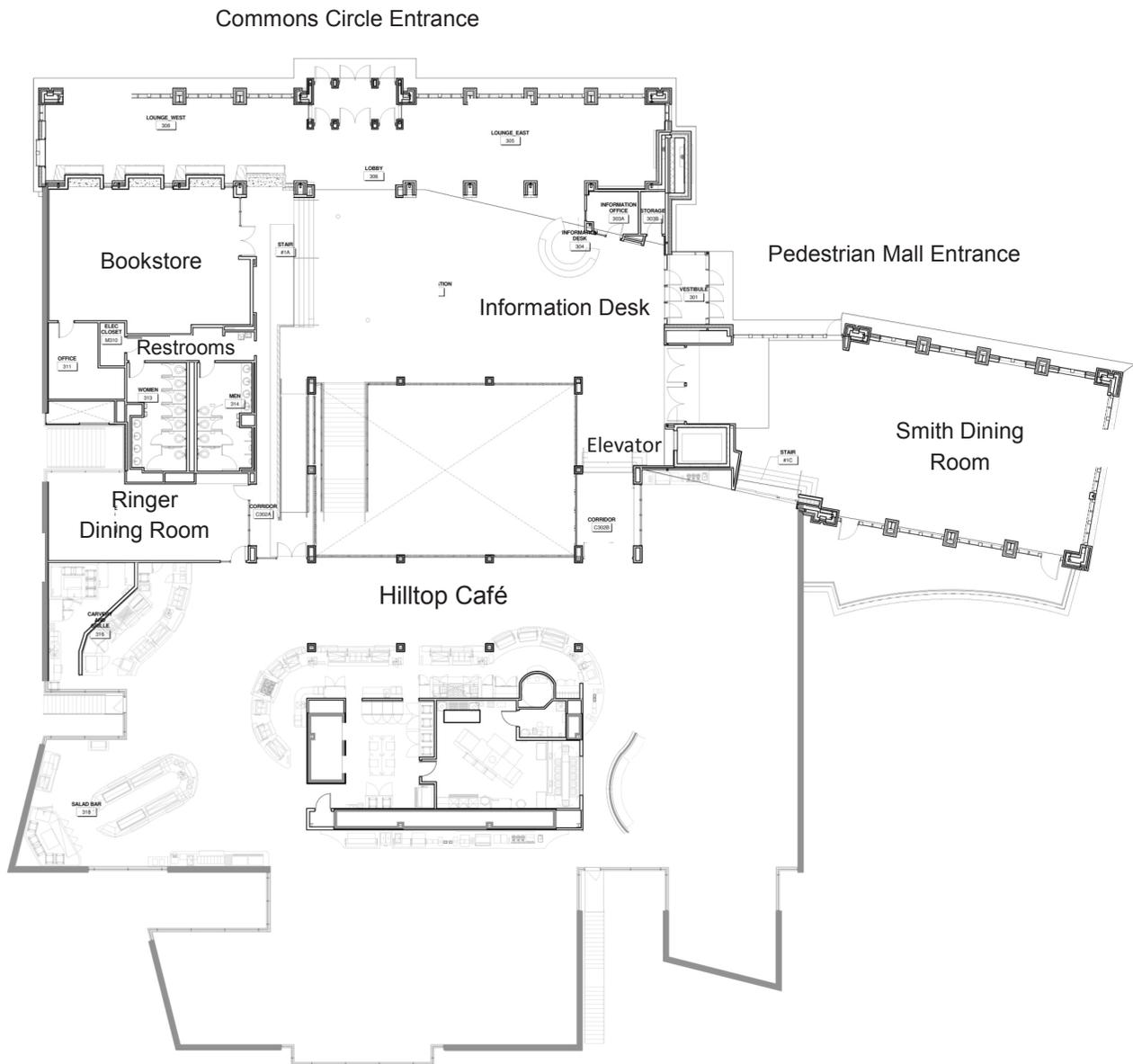
## Poster Symposium Sessions

### Afternoon Session 1:00pm - 2:30pm

- Linkages between Rapid Creek and Putnam Watersheds for Determining Conservation Efficacy** 9b  
*Geology*  
Author: Erin Newman  
Sponsor: Emily Walsh
- Quantifying Physical Changes of Growing Plant Roots** 10b  
*Chemistry*  
Author: Nguyet-Minh Hoang  
Sponsor: Craig Teague
- Growth and Home Range of Juvenile Ornate Box Turtles** 11b  
*Biology*  
Authors: Grace Leppink & Conor Moore  
Sponsor: Andy McCollum
- Вечная Память (Eternal Memory): An Analysis of Survivor Stories from Leningrad and the Soviet Union during the Great Patriotic War** 12b  
*International Relations and Russian*  
Author: Kayne Whyte  
Sponsor: Lynne Ikach
- Characterization of Layer-Bounding Surfaces in a Great Basin Stalagmite Utilizing both Petrographic and High-Resolution Stable Isotope Analyses** 13b  
*Geology*  
Author: Christopher Felt  
Sponsor: Rhawn Denniston
- Sudden Unexpected Death in Epilepsy and Probable Obstructive Sleep Apnea** 14b  
*Chemistry/Biology*  
Author: Thao Luu  
Sponsor: Jeffrey Cardon
- Kundry Is Not Evil: Feminist Investigations of Wagner's *Parsifal*** 15b  
*Music*  
Author: Emily Wenzel  
Sponsor: James Martin
- Correlation Between the Species Morphology and Paleoecology of *Ceraurus* Genus Trilobites** 16b  
*Geology*  
Author: Ryan Shanks  
Sponsor: Kelsey Feser

# The Thomas Commons

## Thomas Commons Upper Level

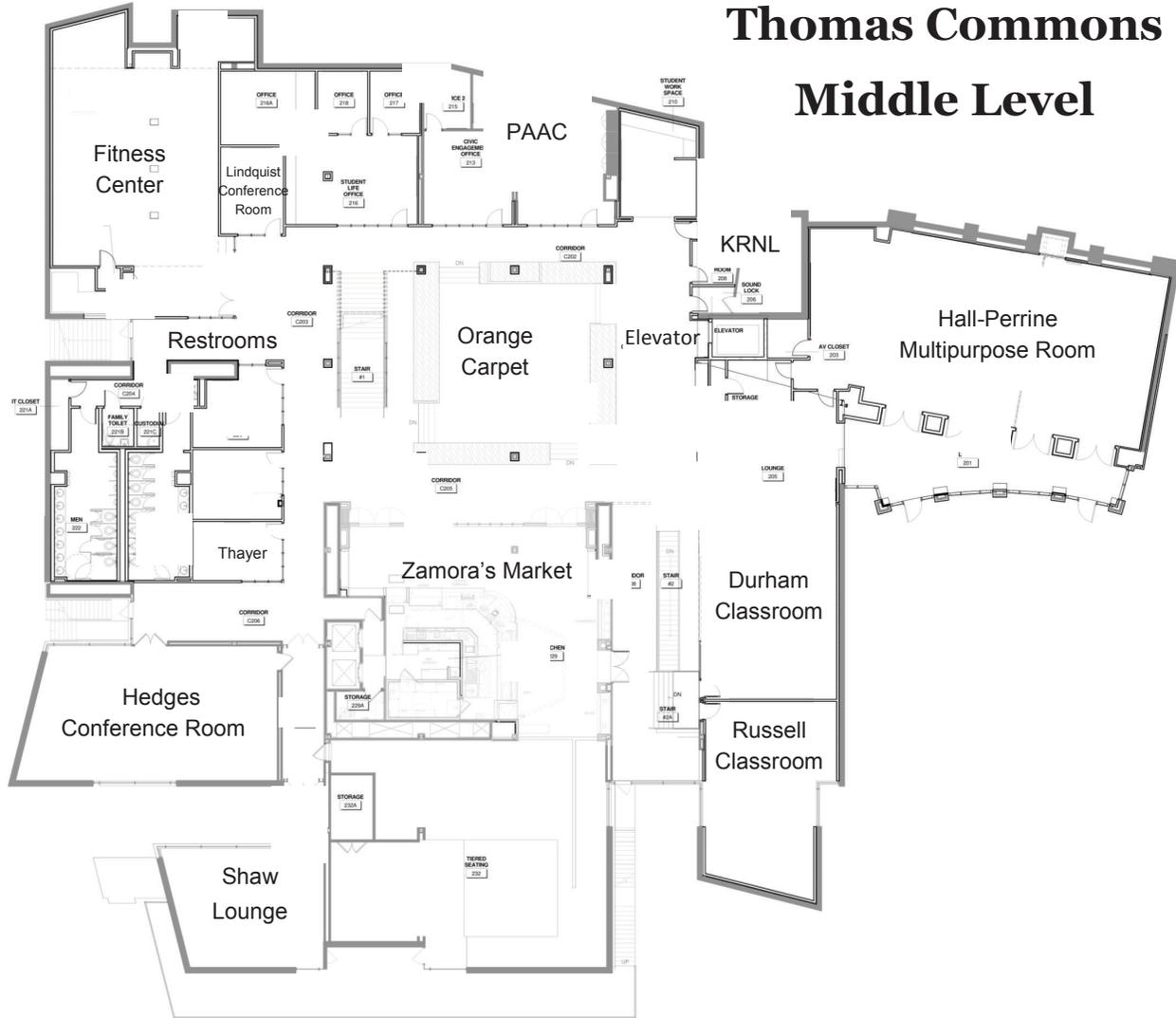


Cornell College

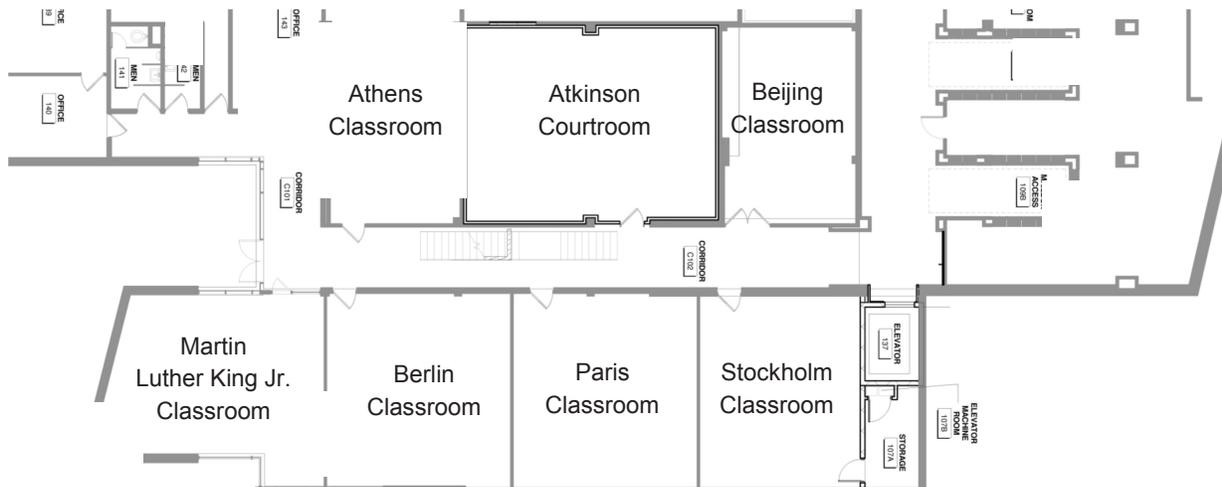
# SYMPOSIUM

## The Thomas Commons

### Thomas Commons Middle Level



### Thomas Commons Lower Level







# ABSTRACTS

**Neelema Ahmed, '16**  
*International Relations*

**Colorado Springs, CO**  
*A'amer Farooqi*

## **Exploring Gender Violence and Women Empowerment in Bangladesh during the Post-Millennium Development Goals Era**

In 2000, the United Nations and its 183 member states at the time committed to eight international development goals known as Millennium Development Goals (MDGs) to be met within 15 years. Women empowerment has emerged as one of the major issues of development and, in an effort to meet the MDGs and reduce global poverty, countries are more aggressively responding to gender and women issues. An example of such a country is Bangladesh, where women empowerment has increasingly become a heavy topic.

Bangladesh is a developing country with a population of 140 million, over 50% of which is comprised of women. Despite constituting half the country's population, women in Bangladesh are bound by social constraints and have been victims of religious prejudices, male oppressions, and various other kinds of discriminations. With the implementation of the MDGs, there has been an increase in the interest in women issues and attempts made by the state and other agencies in promoting the development of women in the country.

Although there have been notable improvements in many spheres, the current examination of the empowerment of Bangladeshi women advocates for a surface-level change in women's lives rather than an institutional change which accommodates women empowerment. Therefore, I would like to propose an alternative framework to define and analyze women empowerment and then evaluate Bangladesh's progress and challenges within that scope.

Redefining women's empowerment as an increase in agency ("the expansion in people's ability to make strategic life choices where this ability was previously denied to them") over time, this presentation will focus primarily on gender-based violence and how efforts to reduce violence simultaneously promote efforts to empower women. I will specifically analyze violence reduction efforts by BRAC, an international NGO based in Bangladesh. BRAC has developed a comprehensive intervention model to address violence against women and children (VAWC); the model consists of prevention, protection, and economic and social reintegration of survivors. Drawing on my personal experience from working on BRAC's VAWC projects, I will explore how their methods can be replicated in not just developing countries, but in the global fight for women empowerment.

**Libby Anderson, '18**  
**Jennifer Davis, '18**  
*Biology*

**Spring Grove, IL**  
**Cherokee, IA**  
*Tammy Mildenstein*

## **Monarch Prevalence and the Survival Rate between Egg and Larvae Stages of Monarch Development**

Monarch butterfly research is relevant to all of those interested in conservation. Even if conservation does not directly interest someone, the popularity of the iconic monarch butterfly tends to engage most. In the past and present, audiences have been excited about the research and wanted to know what they can do to help the monarch butterfly, whether it be planting milkweeds or raising monarchs from eggs to butterflies. Conservation research can benefit greatly from being presented and shared with others inside and out of the conservation community. Monarch butterfly research is just one example of how, when the word is spread, individuals tend to take notice and try to do what they can to help the species at risk.

The research aimed to provide much-needed baseline information for the conservation of the threatened monarch butterfly (*Danaus plexippus*). This study was conducted locally, in three different prairies near Mt. Vernon, Iowa, including Waterworks Prairie, Wickiup, and Indian Creek Nature Center. Prairies were surveyed for milkweed plants using transects. The plants were then tracked for use by monarch butterflies throughout the summer by observing for the presence of monarch butterflies at various life stages. The research results included measures of milkweed density and distribution in the prairies to examine the relationship between prairie size and milkweed abundance. Samples of the milkweeds across the three prairies were measured to determine the role that the plants play in supporting monarchs at three life stages (egg, caterpillar, and butterfly). The resulting relationship between milkweed plants and monarchs helps provide a glimpse of the factors that limit monarch populations. Knowing the limiting factors allows for the creation of ideas for how to bring back the threatened monarch butterfly.

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**Eleanor Backman, '16**  
*Music*

**Burnsville, MN**  
*James Martin*

## **Beethoven's *Fidelio*: An Opera in Search of Class**

Ludwig van Beethoven's sole opera, *Fidelio* (centered on a heroic wife who travels in disguise to save her imprisoned husband), went through three versions and countless revisions, eventually culminating in the 1814 version most often performed today. The work belongs to a long tradition of rescue operas following the French Revolution. These operas typically involve imprisoned victims, heroic rescuers, the dramatic downfall of a villain, and instances of deus ex machina in the finale. The majority of rescue operas also involve imprisoned noblemen, a tradition which Beethoven and his librettists appear to flout in their earlier versions of *Fidelio* (both titled *Leonore*) in their approach to the imprisoned Florestan; he is a commoner. However, the character in the later 1814 version shows familiarity with nobility, and is explicitly a "Don," a title signifying a noble status he was not given in Beethoven's, or any other composer's, earlier settings of the text. The original work by anti-revolutionary Bouilly would suggest that this, too, is an anti-revolutionary move. However, I argue that the reasons for this shift are rooted in Beethoven's main sources and the political context of the time, namely, the abdication of Napoleon, adding a potential layer of political symbolism to the character interactions within the opera.

**Madeleine Ball, '16**  
**MariKate Murphy, '18**  
*Chemistry*

**Dallas, TX**  
**Noblesville, IN**  
*Jai Shanata*

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

Resveratrol, a naturally occurring polyphenol found in red wine, is soluble in oil-like and water-like environments based on its chemical structure. As a result, it has the ability to embed within the lipid bilayer of a cell membrane, potentially altering the bilayer's physical properties. While resveratrol is hypothesized to have life-extending capabilities, the mechanism of this effect is poorly understood. Additionally, resveratrol is metabolized within the body to structurally similar molecules soon after consumption. These metabolites may have similar effects on the physical properties of the bilayer and may play a role in resveratrol's beneficial properties. This research aims to study the bilayer-mediated effects of resveratrol and resveratrol trimethyl ether, a structurally similar molecule, on model cell membranes at nanomolar concentrations. The experiments apply electrophysiology to determine the impact of resveratrol and resveratrol trimethyl ether on lipid bilayer physical properties, which can be measured using lifetime durations of incorporated gramicidin A as a readout of bilayer stiffness. Gramicidin lifetimes were measured in the presence and absence of resveratrol and resveratrol trimethyl ether. Both resveratrol and resveratrol trimethyl ether were found to decrease the stiffness of model cell membranes, thus demonstrating the incorporated molecules' effect on bilayer physical properties at nanomolar concentrations. Preliminary data suggest that resveratrol and resveratrol trimethyl ether may decrease bilayer stiffness in different amounts based upon their structural differences. These effects on cell membrane properties may indicate the mechanism behind resveratrol's purported life-extending properties and the possibility of a link to the function of resveratrol metabolites. Furthermore, since resveratrol is found in red wine, as well as a number of other dietary sources, the reported effects on the model bilayer may demonstrate that bilayer-mediated effects have an impact on human health.

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**Waldyn Benbenek, '16**  
*English & Creative Writing*

**Minneapolis, MN**  
*Michelle Mouton*

## **Satan in Hell**

In the *Inferno*, Dante attributes only a small portion of the last canto to Satan. In this section, Dante describes him trapped in a lake of ice from the waist down. This description has prompted scholars such as T.S. Eliot to describe the last canto as underwhelming. He says, "perhaps it is better, on our first reading of the *Inferno*, to omit the last canto and return to the beginning" (Eliot, 212). He believed that this treatment of Satan was not fitting for the ruler of Hell. I propose a counterargument to Eliot's view of Satan and the last canto. Satan's punishment contains certain aspects that are reflected in other sections of the *Inferno*, specifically, his eternal punishment, self-inflicted encasement in ice, and removal from Heaven. I took those aspects and imposed them onto varying punishments within the other circles of Hell and looked at how those aspects are reflected in circles beyond the ninth, where Satan resides. These aspects betray Satan's role as the sinner on which all punishments are based and not its ruler. Furthermore, looking primarily at his size compared to his small role in the poem and the brief time that Virgil and Dante spend directly discussing him, I have outlined his role as a prisoner in Hell. Finally, I compare Satan's image to other beings of authority in the *Inferno* and illustrate how Satan's depiction is different. I argue then that this is a fitting description of Satan because in the *Inferno*, he is not intended to be a ruler of Hell, but instead another trapped sinner being punished by God.

**Fin Boadu, '16**

*Theatre*

**Guelph, ON, Canada**

*Jim VanValen*

## ***Kinship Dynamics in the War of Gothic Aggression***

Based on an adaptation project I began in Summer 2015 at the Celebration Barn Theatre Company of South Paris, Maine, *Kinship Dynamics in the War of Gothic Aggression* is a one-person performative work that explores racial identity and ancestry through the double lens of the my own experience in contemporary Western culture and the imagined historic lens of descendants of Aaron the Moor from William Shakespeare's *Titus Andronicus*. In the play, Anthony, a son (or grandson) of Aaron, explores what it means to grow up as the personified house divided, both Moor and Goth, in a country hostile to both identities. How does one navigate society when one's physical presence is a political statement? How does one manage generations of oppression and turmoil? In exploring these questions, Anthony accidentally begins a journey of not only self-discovery, but one that also asks the audience to analyze the residual impact of colonialism and white supremacy in both larger social structures and in spaces as intimate as interpersonal relationships.

In this theatrical performance presentation for the 2016 Cornell College Student Symposium, I, as playwright and performer, will present the first 5 minutes of *Kinship Dynamics* and a critical analysis not only of the story and its sociopolitical context, but also the process of shaping and developing experimental plays. Theatrically, the work draws influence from the gamut of avant-gardists including Bertolt Brecht, Gertrude Stein, Lee Breuer, Anne Bogart, Ntozake Shange, and Andre Alexis, influences which will be touched upon in lecture, as well as the work's status as a novel continuation of my mother's research on inter-ethnic marriage and on decision-making in abusive relationships. The lecture will conclude with observations about presenting excerpts from a work that is still in development and the potential for shaping and reshaping narratives that "non-traditional" approaches to theatre production provide.

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**Fin Boadu, '16**

*English & Creative Writing*

**Guelph, ON, Canada**

*Leslie Hankins*

## **An Awkward Silence: Classic Avant-Garde Film Techniques Re-Explored**

After analyzing primary sources from the nationalist cinema scenes of the 1920s and 1930s, such as films, essays, and manifestos, I wrote and directed two short works, *L'Oiseau Sur un Feu* and *Platzangst*, which respectively replicate and reimagine the foundational cinematic techniques of classic French and German avant-garde films, like *Un Chien Andalou*, *L'Etoile De Mer*, *Metropolis*, and *The Cabinet of Dr. Caligari*. Specifically, *L'Oiseau Sur un Feu* explores the visual puns, twisted humor, and abstract movement sequences popular in the French avant-garde, marrying Germaine Dulac's ideology of cinema as a way of capturing light and Dali and Buñuel's attempts to explore the unconscious and subconscious mind. *Platzangst*, on the other hand, dives into the dark psychology of the German avant-garde film, raising philosophical questions about identity and the mind, and creating a world that recognizably pays tribute to the history of the German Expressionist cinematic movement. The influence of the classic filmmakers is salient and, as an electronic poster presentation, these two scored, silent films will be set up to run on loop, with a total run time of approximately 10 minutes, pausing when necessary to facilitate discussion and question-answering.

Hannah Bostwick, '16  
*Art History*

Rochester, MN  
*Christina Penn-Goetsch*

## Early Modern Perceptions of the *Borghese Sleeping Hermaphroditus*

The *Borghese Sleeping Hermaphroditus* has puzzled, fascinated, and titillated people for centuries. This marble sculpture dates from 2<sup>nd</sup> century B.C.E. Rome and depicts a recumbent youth, voluptuous and unblemished, who appears female, with round hips, buttocks, and breasts. Then the observer sees the male genitalia nestled between the figure's legs. The statue is an image of the god Hermaphroditus, the child of Venus (Aphrodite) and Mercury (Hermes). When the statue was unearthed in 1608, it was purchased by Cardinal Scipione Borghese, who added the statue to his collection, going so far as to give the *Sleeping Hermaphroditus* its own room, the Sala dell'Ermafrodito. In 1620, the Cardinal commissioned Gian Lorenzo Bernini to create a gorgeous cushioned mattress for the statue to lie upon. Napoleon took the statue with him to France in 1807, where it became part of the collection that is now in the Louvre. Despite its popularity, little has been written about the work beyond tidbits of information scattered through books. Although highly-specific information is not readily available, we can come to understand how this work was appreciated as an ideal during the early modern era.

In this paper, I will explore the idealism suggested by the *Hermaphroditus* through the examination of material found in medical, alchemical, and even religious sources. This information will augment a discussion of the discovery of the work and how the recumbent figure was displayed in the villa. By examining these perspectives, I will highlight how the statue is an embodied perception of perfection—sexually and spiritually—that still might be deemed appropriate to a location such as a cardinal's home.

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Ashley Brodell, '16  
*Psychology*

Salisbury, MD  
*Melinda Green*

## The Influence of the Hypothalamic-Pituitary-Adrenal Axis on the Development of Psychosis

Psychotic disorders are among the most devastating mental illnesses because of severe positive (hallucinations, delusions, etc.) and negative (social withdrawal, amotivation, etc.) symptoms that have detrimental impacts on the lives of sufferers. There are a range of neurochemical and structural abnormalities identified in the brains of psychosis sufferers. These abnormalities are thought to develop and progress because of a genetic predisposition for disease development, which is expressed under stressful conditions. This is called the diathesis-stress model of psychosis. The perception of stress is associated with activation of the hypothalamic-pituitary-adrenal (HPA) axis, which results in the release of cortisol, a stress hormone that binds to glucocorticoid receptors that are present in the mesolimbic system. Increased glucocorticoid secretion and binding leads to dysregulation in multiple neural pathways, resulting in psychotic symptoms. This presentation aims to review the influence of the most universal neurological indicators of psychosis progression, with dysregulation of HPA axis activation as the central focus. Research has shown that long-term and abnormal HPA axis activation has a variety of negative consequences in high-risk individuals.

**Ashley Brodell, '16**  
*Psychology*

**Salisbury, MD**  
*Sue Astley*

## **The Effects of Diminished Proprioception on Cerebellar Development in ErbB2 Knockout Mice**

The cerebellum is a brain region that is associated with proprioception (the ability to sense the position of limbs in space), and has a protracted developmental period. Research suggests that postnatal development of the Purkinje cell (PC) layer in the cerebellum of rodents is dependent on neural activity. PC development is characterized by polyinnervation of climbing fiber inputs from the inferior olive during postnatal week one, and by postnatal week two, PCs are predominantly innervated by a single climbing fiber. One contributor to PC development is thought to arise from changes in neural activity due to proprioceptive feedback of myoclonic twitches observed during active (or REM) sleep. To further examine the role of neural activity on cerebellar development in infant rodents, we used postnatal day 8-9 (P8) and postnatal day 14-15 (P15) mice. Mice with a conditional knockout (KO) of the ErbB2 gene in skeletal muscles were compared with wildtype (WT) littermates. The ErbB2 gene is essential for the development of muscle spindles, which are integral to proprioceptive feedback. We hypothesized that KO mice would exhibit less climbing fiber innervation due to diminished proprioceptive feedback during development. To test this, we observed labeling of vesicular glutamate, an excitatory neurotransmitter, of climbing fibers in the somatic and molecular layers of KO mice in comparison with WT controls. Results showed that P15 KO mice have smaller PC diameter and less climbing fiber translocation than WTs. This suggests that proprioceptive feedback from muscle spindles to the cerebellum is an important provider of neural activity during PC development and climbing fiber translocation.

## **Active vs. Nutritional Vitamin D Supplementation for Patients with Stage IIIB to IV Chronic Kidney Disease and its Effect on Inflammatory Protein Response and Risk of Cardiovascular Disease**

Kidney dysfunction leads to many different diseases, including chronic kidney disease (CKD) (Kendrick & Choncol, 2008). In the USA alone, 11.5% of the population suffers from CKD (Kendrick & Choncol, 2008). The main cause of death in the CKD population, before these patients reach end-stage renal failure, is cardiovascular disease (CVD) (Karras et al., 2012; Gansveroot et al., 2013).

A chronic inflammatory state in the blood vessels is a hallmark of CKD leading to CVD (Kendrick & Choncol, 2008). This inflammatory state leads to endothelial dysfunction, a non-traditional risk factor for CVD (Kendrick & Choncol, 2008). Therefore, severity of the dysfunction can provide important information on a patient's risk for CVD (Kendrick & Choncol, 2008). Endothelial dysfunction can be measured using bio-inflammatory markers such as NF-kB (Kendrick, 2014).

NF-kB is a transcription factor that regulates the transcription of inflammatory cytokines in blood vessels (Kempe, 2005). Overexpression of NF-kB can lead to a chronic inflammatory state, a symptom of CKD and CVD (Kempe, 2005). Kendrick (2014) and Inaguma (2008) found that CKD patients seemed to have low serum levels of vitamin D. When these patients were treated with vitamin D supplements, bio-inflammatory markers such as interleukin-6 and NF-kB were markedly reduced (Kendrick, 2014; Inaguma, 2008).

We are examining the relationship between vitamin D treatments and endothelial dysfunction by examining the inflammatory protein NF-kB in endothelial cells using immunofluorescent antibody staining. Endothelial cells were collected from 128 stage IIIB to IV CKD patients using cannulation before and after treatment with two different types of vitamin D supplements, calcitriol (active form of vitamin D) and cholecalciferol (dietary supplement). The purpose of this study is to compare the efficacy of calcitriol to cholecalciferol in treating inflammation in CKD patients. If these treatments reduce inflammation as assessed by our biomarkers, then vitamin D may be used to treat CKD patients for chronic inflammation to prevent cardiovascular events in the future.

## **Between the Lines: What Can We Gain from a Queer Reading of *Anne of Green Gables?***

Since its publication, Lucy Maude Montgomery's novel *Anne of Green Gables* has defied any 'obvious reads' by critics. Ostensibly a morality tale for girls about an unruly red-headed orphan who learns to be a young lady, readers identify more with the 'wild' Anne in the beginning of the novel than the demure young woman at the end. It could not be called literary because Montgomery was a woman writing for girls. Even though the novel has never gone out of print and remains a staple in every North American school library, it is not considered a work of literature because of Montgomery's gender and her assumed audience. Perhaps understandably, then, the novel was largely ignored by scholars until the past two decades. Even still, scholarship focuses on feminist or autobiographical readings of the novel. However, these readings have more to do with Montgomery and her work than with her novel. This paper gives an overview of these major theories—feminist and autobiographical—commonly used to unpack Montgomery's novel, how they work, and their limitations.

The best reading of *Anne of Green Gables* is a queer one, which looks at ways the text both conforms and rejects reader and genre expectations. Queering children's books shows critics not just the complexity of children's books, but how children themselves are complex beings that resist adults' attempt to classify, particularly by what is considered appropriate in children's literature. It allows us to read the contradictions between the book Montgomery claims to have written, a simple romance for young girls, and the one she actually wrote, a subversive book about the relationships of women.

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**Mason Chow, '16**  
**Phyo Lin, '16**  
**Chris Gonzales, '16**  
*Physics*

**Washington, DC**  
**Yangon, Myanmar**  
**Melrose, MA**  
*Derin Sherman*

## **Acoustic Levitation**

Acoustic levitation is the process of lifting objects in the medium by using intense acoustic pressure from ultrasonic waves. Acoustic levitation devices have been developed for suspending and moving objects in mid-air. This groundbreaking technique can be useful for manipulating very delicate objects without having any physical contact. For example, chemical reactions can be observed in a frictionless bearing, which reduces the risk of contamination. Sound waves travel through air by compressing and decompressing air particles, thereby creating pressure points in the medium. The superposition of the newly emitted sound waves and the reflected waves produce standing waves with pressure nodes. When the sound waves induce enough acoustic pressure, the propagating sound waves will be able to levitate objects of certain mass. The acoustic pressure nodes are separated by half of a wavelength of the emitted sound. The crux of acoustic levitation is trapping small particles at the pressure nodes of these standing waves. In our project, we built a functional acoustic levitation device that can lift small objects such as water droplets and balsa wood pieces. Our setup includes a transducer that produces high-frequency sound waves, a reflector that reflects the waves back to the source, and a high-voltage supply. We have molded a concave reflector and, most importantly, developed the circuit that controls the ultrasonic transducer. Our circuit produces a modified sine wave at 28 kHz and we levitated light objects at 50 V. At the end, we achieved our goal to levitate water droplets.

**Mason Chow, '16**  
**Lainey Drevlow, 16**  
*Mathematics & Statistics*

**Washington, DC**

*Tyler Skorczewski*

## **Computational Model of Tumor Angiogenesis**

A one-dimensional mathematical model was built to describe the initial process of angiogenesis, where tumors grow blood vessels in order to sustain further development. The experiment used two partial differential equations: one modeling the concentration of chemicals that promote angiogenesis and one modeling the behavior of endothelial cells during the forming of the blood vessels. The equations for both concentrations of chemicals and endothelial cells involve a diffusion term. While having a diffusion term, the equation for the endothelial cells also includes a chemotaxis term, which contributes to the movement of the cells toward higher concentrations of chemicals. The computational approach uses a combination of backward and forward finite difference methods for time-stepping and a centered difference method in mesh spacing. Our results show several intriguing properties when chemicals and endothelial cells react during diffusion. Through experimentation, we found a set of parameters that give rise to angiogenesis. By solely increasing the chemotaxis term in this parameter set, our results show no angiogenesis. Another property is that the population of endothelial cells will continue to decay until the concentration of chemicals approaches equilibrium. Although many of the coefficients are arbitrary, we have successfully created a computational approach to solving the partial differential equations in this model. Further research for the coefficients of this model will aid cancer research since tumors are usually benign prior to angiogenesis.

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**Andrew Crow, '16**  
*Psychology*

**Whitefish Bay, WI**  
*Alice Ganzel*

## **The Role of Personality in Sustained Attention and Response Inhibition**

The extant literature on personality and psychopathology indicates effortful control mechanisms are theoretically related to executive functioning. The present study examines the role of conscientiousness, extraversion, neuroticism, and grit in performance on the Test of Attentional Vigilance (TOAV) in a sample of male ( $n = 27$ ) and female ( $n = 23$ ) adults. Researchers hypothesized conscientiousness and grit would negatively relate to standard deviation of reaction time (SDRT), reaction time variability (RTV), and omissions errors, implying more regulated attentional processes. Additionally, conscientiousness and grit were hypothesized to be negatively related to mean reaction time (MRT) and commission errors, suggesting more efficient inhibition of prepotent motoric responses. Lastly, neuroticism was hypothesized to be positively related to MRT, SDRT, RTV, omission errors, and commission errors, suggesting less efficient executive control mechanisms. Multiple regression analyses utilizing personality measures did not significantly predict MRT, SDRT, RTV, omission errors, or commission errors ( $ps > .05$ ). Bonferroni-corrected analysis of variance models indicated statistically nonsignificant mean differences between high and low conscientiousness, high and low grit, high and low extraversion, and high and low neuroticism in relation to all variables of interest ( $ps > .05$ ). Binary logistic regression analysis indicated a statistically nonsignificant relationship between omission errors and personality measures ( $p > .05$ ). Implications, limitations, and recommendations for future research will be provided in context.

David DeMoss, '19  
Aiden Litt, '19  
Huong Quynh Anh Nguyen, '19  
Isabella Blackburn, '19  
*Biology*

Holland, MI  
Superior, CO  
Moscow, Russia  
Twin Lakes, WI  
*Tammy Mildenstein*

## The Effect of Acetamidophenol on Betta Fish

The United States is home to one of the leading markets for pharmaceutical drugs. Because this is the case, its citizens tend to use a lot of pharmaceutical products in their everyday lives. Some of the compounds present in many of these drugs never completely metabolize out of the body; as much as 90% of a dose can be excreted from the body in urine and enter the sewage system. Pharmaceuticals can also enter wastewater from a number of other potential sources, including landfill sites, direct human disposal of drugs, and from livestock waste.

This, theoretically, should not matter since we have systems in place to monitor the levels of pharmaceuticals in our drinking water, and, according to our government, methods to properly purge all traces of these drugs from our wastewater. However, the majority of countries today do not have any active monitoring programs that routinely test for the presence of pharmaceutical compounds in water supplies. Many studies have detected the presence of pharmaceuticals in water supplies around the world. Although the concentrations are seemingly small, being found only around a few nanograms/liter, they can still have a potential impact on humans and animals alike. The latter category, especially non-mammalian animals like fish, are woefully understudied.

With pharmaceutical pollution already present in the world's waterways, studies have shown that even very small amounts of these pollutants can have a sizeable effect on fish behavior by disrupting the critical behaviors that help fish survive in their environment. These behavioral disruptions would also magnify damage from existing threats, like more ecologically-fit invasive species and chronic overfishing.

The betta fish (*Betta splendens*) was a good species of fish to use in the experiment because they are known mainly for their aggressive behavior towards other fish, and even their own reflection, so if the drug had any disruptive effects, it would be readily apparent. Tylenol (or acetaminophen) was the best experimental drug because it was readily available and many people all around the world use it to relieve their pain. In addition, new research into Tylenol has shown that it has a sizeable effect on anxiety, so its global use is likely to be on the rise in the future, and thus it will be more prevalent in the environment. This study should be seen as a foundation for other studies on the effects of pharmaceuticals on wildlife behavior. If enough of an overall detrimental correlation is supported by these studies, then it might lead to federal regulations on pharmaceuticals that would incentivize a more scrupulous level of water filtration, which would not only benefit the wildlife, but also expose us to lesser amounts of potentially damaging chemicals.

**Raisa Ebner, '17**  
**Jacob Lehman, '16**  
*Physics*

**Portland, OR**  
**Iowa City, Iowa**  
*Derin Sherman*

## **Building Resonance**

This project has to do with the resonance of a building in Memphis along the New Madrid fault line. The building designs were copied to make both a physical model (made out of balsa wood that stood four feet tall) and a computer model (made on PTC Creo). Both models were used to look at how the building would shake under earthquake conditions. This was done by putting the physical model on a shake table and testing the digital model by doing a model analysis within the same PTC Creo program with which the model was made. A few of the models found on the computer were successfully replicated with the physical model by varying the frequency at which it was vibrated. Adaptations were then made to the building to try to dampen out some of the resonance so that suggestions could be made on how to fortify the building against an earthquake. These modifications included weighting the top of the building, adding bracing on the sides of the building, and putting weights on springs on the top. It was found that bracing on the sides of the building worked the best, though more experimentation with the weights on springs would be interesting because more weight had a big effect based on how little weight was added. With more research, it is hoped that a way can be found to easily dampen out the resonance of the building to make it earthquake-safe.

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**Shannon Ehrnstein, '16**  
*Russian*

**Strasburg, CO**  
*Lynne Ikach*

## **The Difficulties of Translation**

The art of translation has been practiced for centuries, playing a key role in communication between individuals and cultures. However, in an age where electronic resources can be used to quickly translate from one language to another, accurate and ethical translation becomes increasingly important. Ethical translations must be true to the purpose for which they are written, while still remaining faithful to the material of the original. However, depending on the purpose of the translation, the translator may emphasize preservation of the original form or may transform the text into a new work of literature that still contains the main content and spirit of the original. Beyond the ethics involved in translating, there is the process of translation itself, which contains many difficulties and considerations in every step, from analysis to revision. Translators must reword almost every sentence, and sometimes the structure makes it impossible to rephrase a sentence neatly into the target language.

A familiarity with the ethical concerns and difficulties involved in the process of translation provides a solid base for choosing which translations to trust. As such, this poster will present several examples of ethical codes and paths followed by today's translators. This includes an outline of common preferences as to the purpose of a translation. Additionally, the poster will outline some of the common difficulties faced by literary translators and their means of dealing with them. Finally, it will provide information on the process of translation itself, using my translation of "Царевна лягушка" ("The Frog Princess") as an example.

**Jay Epps, '16**  
*Theatre*

**Saint Louis, MO**  
*Janeve West*

## ***Hear Me Roar: Using Devised Theatre to Amplify the Voice of a Community***

Devised theatre is a process of new play development that is based in the ensemble and what each member brings with them. The process for the devised piece, *Hear Me Roar*, was no different, with the additional goal of bringing together a small and diverse community of women to create a show about women. The production was developed through a community-based approach to devised theatre and drew heavily from the work of Cornerstone Theatre Company.

*Hear Me Roar* was developed and performed earlier this year and explored the ideas, stories, and experiences of a community of women. The show started only from an idea, and through the collaboration of the ensemble, five women were able to give voice to their community. The production discussed love, sex, consent, assault, grief, laughter, heartbreak, and redemption. The devising process was used to create the pieces written for the show and, more importantly, to facilitate community engagement and discussion.

This presentation will focus on the use of devising to facilitate discussions within the community of women involved in the production. The presenter will discuss the generative rehearsal process and how the process was used to strengthen the community and to create safe and inclusive discussions of community issues.

Selena Erdman, '16  
*Art History*

Beaver Dam, WI  
*Christina Penn-Goetsch*

## Saint Philomena as Delaroche's *Young Christian Martyr*

Two people stand along a path, stopped in their tracks, as they happen upon the body of a beautiful young girl floating lifeless in the water ahead. They look horrified, one collapsing against the other in shock. This is the profound effect of Paul Delaroche's *Young Christian Martyr* of 1855. The painting moves all who come upon it, yet few have ever studied it in depth or attempted to understand the circumstances surrounding its creation. Two prevailing interpretations remain: that from the standard Delaroche scholars and that of more contemporary reviews and casual observers. Delaroche scholar Stephen Bann and French scholar Claude Allemand-Cosneau argue that there is a connection to Millais' *Ophelia* of 1852. Even recent reviews from *The London Times* of 2010 recognize the resemblance and call her a "Christian Ophelia." Still other contemporary reviews romanticize the work and analyze it solely as a biographical commentary on the artist's life, as they see the work as a vision of Delaroche's own impending death or as a memorial to his beloved wife's passing. While the *Ophelia* motif seems to hold true, this presentation argues that the artist's biography is not the best way to understand this work.

Previously, the young martyr's identity has not been identified or treated as in any way integral to the interpretation of the work. This oversight is perhaps the most crucial piece of the puzzle missing in the attempts to understand the work fully. This paper will illuminate the identity of this young Christian martyr as Saint Philomena and build upon the scholarship of Bann and Allemand-Cosneau. This foundation will explain why we should consider this an image of a Christian *Ophelia* that is in dialogue with the Pre-Raphaelites of London and the convictions of nineteenth-century Paris—a context that celebrated the role of Saint Philomena.

**Christopher Felt, '16**  
*Geology*

**Provo, UT**  
*Rhawn Denniston*

## **A Detailed Chemical and Microscopic Investigation of an Ice Age Stalagmite from Lehman Caves, Nevada**

The idea that human activity is driving recent global climate change has gained scientific consensus and entered the public spotlight. It is up to scientists such as paleoclimatologists to understand the nature of climate change and how the activities of people might affect it. The goal of paleoclimatology – the study of past climates – is to expand our record of climate change and help us understand what the future holds.

One of the most hotly debated topics in paleoclimatology has been the ice age climate record of the Great Basin region of the western US over the past ~500,000 years. A new stalagmite-based record of climate change in the Great Basin region constructed by Lachniet et al. (2014, *Nature Communications*, 5, 4805) seems to have solved this controversy, but it only extends back 175,000 years. The aim of our research is to help extend this record through a coupled petrographic and high-resolution stable isotopic analysis of a stalagmite that grew discontinuously in Lehman Caves, Nevada between ~650,000 and 243,000 years ago.

High-resolution stable isotope analyses drilled up to and across growth hiatuses in this stalagmite reveal that the oxygen isotope value becomes progressively more negative (the ratio of  $^{18}\text{O}$  to  $^{16}\text{O}$  decreases) towards the termination of the hiatus. This trend is interpreted to be the result of a consistent change in the processes that control the oxygen-isotope value of dripwater in Lehman Caves, such as a shift in the dominant sources of precipitation. The carbon isotope value (the ratio of  $^{13}\text{C}$  to  $^{12}\text{C}$ ) exhibits less consistency at the hiatuses, however, and may reflect multiple effects such as variations in vegetation density or soil water residence times. Overall, petrographic and high-resolution stable isotope data of the stalagmite may offer an additional method of deciphering climate change that wasn't possible with a typical stable isotope analysis.

## Characterization of Layer-Bounding Surfaces in a Great Basin Stalagmite Utilizing both Petrographic and High-Resolution Stable Isotope Analyses

Layer-bounding surfaces in stalagmites represent hiatuses in growth due to either erosion during wet climate periods (type E layer-bounding surfaces) or a period of lesser deposition when climate is relatively arid (type L layer-bounding surfaces; Railsback et al., 2013, *Int. J. Spel.*, 42, 167). Accounting for layer-bounding surfaces not only offers an additional method of tracking past climate change, but can also be useful when constructing stalagmite chronologies.

We conducted a petrographic and high-resolution stable isotopic analysis of the layer-bounding surfaces in stalagmite LMC-1 from Lehman Caves, Nevada. Fourteen  $^{234}\text{U}$ - $^{230}\text{Th}$  ages show that deposition occurred discontinuously between ~659 – 243 ka, with two hiatuses at ~243 ka and ~387 ka, within error of interglacial periods (MIS 7 and 11, respectively). A third, less well-defined hiatus at ~308 ka may also be the result of arid climate during MIS 9. One additional hiatus with a poorly constrained age (U-series ages show only that it occurred between ~659 – 423 ka) may have occurred during interglacial period MIS 13. Petrographic observations of these hiatuses reveal they are type L layer-bounding surfaces, suggesting arid Great Basin climates similar to the Holocene.

High-resolution (100  $\mu\text{m}$ ) stable isotope analyses drilled up to and across each hiatus reveal that  $\delta^{18}\text{O}$  values become progressively more negative towards the termination of each layer-bounding surface. If increases in evaporation or prior calcite precipitation had dominated at these hiatuses, an opposite trend would be expected, with  $\delta^{18}\text{O}$  values becoming progressively more positive. The isotopically light trend is thus interpreted to be the result of a consistent change in the processes that control the  $\delta^{18}\text{O}$  value of drip water in Lehman Caves, such as a shift in the dominant sources of precipitation.  $\delta^{13}\text{C}$  values exhibit less consistency at the L surfaces, however, and may reflect multiple effects, such as variations in vegetation density, soil water residence times, or variations in the  $\text{pCO}_2$  of the cave atmosphere. Overall, petrographic and high-resolution stable isotope data of LMC-1 may offer an additional method of deciphering climate change that was not possible using coarse-resolution stable isotope data.

**Fiona Flynn, '16**  
*Environmental Studies*

**Palo Alto, CA**  
*A'amer Farooqi*

## **Marketing, Distribution, and Sustainability in the Food System**

According to a 2013 study conducted by Oxfam International, our food system employs one third of the global workforce. This same study states that the 10 largest food corporations control more than half of the global market, meaning that their policies and purchasing have a huge impact on the world's diet, employment, and physical environment. In America specifically, the average farm size is 441 acres, compared to 147 in 1900 (Agricultural Council of America). Advancements in farming techniques and technology have allowed us to produce a higher quantity of food while reducing human labor inputs. However, this newly developed efficiency is controversial. Some issues have arisen with the environmental impacts associated with these technologies, for example, erosion, synthetic chemical runoff, and carbon emissions associated with transportation. Rates of diet-related disease are also on the rise in America, which is pushing Americans to look for alternative food producers. As we look for solutions to these and other problems with our food system, an increasing number of people are turning to smaller, sustainably-oriented businesses to purchase their food. These producers claim to offer quality, 'natural' food that is produced with less impact on the environment than their industrial, corporate counterparts. In this transition to a healthier, more environmentally sustainable marketplace, this project asks how these newer, 'healthier' producers are planning on competing with the established industry giants. These producers are an important part of long-term life on this planet, and studying ways in which they can remain successful in our capitalist society will be essential to ensuring that the United States progresses towards a sustainable future. This research project analyzes a few of these sustainable businesses and draws some conclusions about their successful strategies.

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**Laurel Fraser, '16**  
*English & Creative Writing*

**Urbandale, IA**  
*Michelle Mouton*

## **Literal Meaning and Literary Meaning: A Study on the Translations of John 3:16**

English translations of the Bible are generally expected to be more or less "faithful" to the original Greek and Hebrew, and in order to do so, there are various decisions that translators must make. Some translators may focus on keeping the English as literal as possible to the host language, others may desire to keep the same tone, while still others may place emphasis on putting scripture into modern English. Each of these decisions will have its own impact on the meaning of the words. This essay provides a close reading to assess multiple ways that meaning shifts depending on the literary choices the translators have made with respect to diction, meter, and punctuation. The essay delves into the heart of one of the core scriptures in the Bible—John 3:16 and its surrounding verses—in an attempt to assess what has been changed, reveal why translators offer new versions, and uncover what is to be gained from these changes. The specific translations reviewed are the King James Version (1611), the Revised Standard Version (1952), the New Revised Standard Version (1989), and The Message (2002).

Stefano Garcia Riefkohl, '16  
*Geology*

Acapulco, Mexico  
*Jonathan Baker*

## Hydrological Response to an Increasingly Warm Volga Region

Western Russia has warmed at nearly twice the global rate over the past century; however, despite it being a major center of agricultural production, the hydrological response to such warming has not been well constrained. This investigation analyzes Mg and Sr variations in a U-Th dated stalagmite from the Volga Basin of the Southern Ural Mountains, which were interpreted to reflect local precipitation and water residence time from roughly 11,700 to 1,800 years BP. Pollen data indicate that the modern and forested landscape has been in place for roughly 10,000 years, and this vegetation has been the major source of carbon for the underground caves. Previously reported  $\delta^{13}\text{C}$  values of our cave were interpreted to reflect changes in warm-season precipitation. Such changes support the Mg data, and suggest a drying trend during the last four centuries of stalagmite growth. Previous isotope data reveal that  $\delta^{18}\text{O}$  tends to slowly increase, which suggests the region has gradually warmed since the beginning of the Holocene. Precipitation changes have not been as continuous; moreover, the chemical ratio data suggest that the Volga climate became increasingly humid following the Younger Dryas, stayed relatively wet throughout the Holocene climatic optimum, and has progressively become drier ever since. Unprecedented warmth and dryness in the future climate threatens agricultural sustainability in otherwise fertile lands, which majorly affects populations that depend on Russian food production.

**James Garrett, '17**  
*Geology*

**Fountain, CO**  
*Rhawn Denniston*

## **Stalagmite Records of Climate Change Spanning the Last 500,000 Years from Cape Range, Western Australia**

Paleoclimatology is the study of past climates through the use of climate proxies, geologic or biologic records that preserve evidence of temperature or precipitation prior to those periods recorded by humans. Stalagmites, mineral deposits formed from dripwater on the floor of caves, are useful as paleoclimate proxies for two reasons. First, they can be precisely dated to ~500,000 years ago, and second, carbon and oxygen isotopes in stalagmites track a variety of climate signals. Oxygen values change due to where the precipitation comes from, how much it rains, air temperature, and the distance the atmospheric moisture traveled, while carbon reflects moisture and plant activity above the cave system.

This project involves a stalagmite reconstruction of climate change from Cape Range, Western Australia over portions of the past 500,000 years. A prominent source of uncertainty in Australian paleoclimate is the influence of the Northern Hemisphere (NH), particularly heating of the Asian landmass, on Australian monsoon rainfall. Stalagmites from China have shown that the Eastern Asian Summer Monsoon (EASM) reflects NH insolation, the amount of solar radiation that reaches earth's surface, which allows for heating of landmasses. However, the role of NH insolation on Australian paleoclimate has remained poorly constrained because Australia has few high-resolution continental records spanning hundreds of thousands of years.

Cape Range is well-situated for recording changes in Australian hydroclimate. This region marks the boundary between monsoon rainfall coming from the tropics and middle-latitude rainfall from the south. We find similarities between monsoon trends recorded by stalagmites from China and stable isotopic trends in stalagmites from Cape Range. Both oxygen and carbon isotopes in Cape Range stalagmites suggest that elevated rainfall occurred during times with a stronger EASM. These times of stronger EASM are marked with more positive oxygen values and more negative carbon values. The dates of these observed peaks are roughly 470,000; 270,000; 100,000; and 10,000 years ago. There are still unanswered questions as to why we see these peaks.

**Brian Gilg, '16**  
*German*

**Urbandale, IA**  
*Tyler Carrington*

## **Name Change: The Story of Berlin, Iowa and German-Americans in World War One**

During World War I, various aspects of German culture in the United States were suppressed or put under great strain. Sauerkraut became "Liberty Cabbage," Dachshunds became "Liberty Hounds," and German measles became "Liberty Measles." Orchestras stopped playing works by Beethoven and Mozart and, in an ironic case of foreshadowing, books written by German authors were burned.

Iowa, with its large German population, was not immune to this wave of paranoia. The case of Berlin, Iowa is just such an example. In May 1918, Governor Harding enacted the so-called "Babel Proclamation," which banned all languages besides English in public settings, including all schools and religious buildings. Shortly afterward, 40 men voted to change the name of Berlin, Iowa to Lincoln, a name which it has still today.

Officially, this change was a result of patriotic sentiment of the town's residents in order to allay any suspicions by non-residents. However, stories of other communities facing attacks of an anti-Germanic nature, coupled with the length between the US entrance into the war and the decision to make the change, create a substantial space for research and evaluation.

This presentation will center around research conducted at the University of Iowa Special Archives and the Iowa State Historical Society. Especially in focus will be the collected documents and papers of Berlin, Iowa resident Ted Rehder. His documents include maps, postcards, and letters from Central Europe and the US. His personal story is closely entwined with that of Berlin, Iowa. Local German-language newspapers from the time period will also be studied in order to provide context, as well as the German-American viewpoint throughout the war. Themes of immigration, assimilation, and what truly makes someone an American will be explored.

These themes are timeless and instructive. At a time when massive migrations of people from the Middle East to Europe are taking place and subsequent challenges have resulted, the story of Berlin, Iowa provides a parallel that serves as a reminder that current crises are not wholly unprecedented; they have occurred before. New solutions can be found when the past is studied.

**Arturo Hernandez, '16**  
*Art History*

**Montebello, CA**  
*Ellen Hoobler*

## **Redefining Art History: Making and Printing 3D Digital Models of Ancient Tombs from Mexico**

During the summer of 2015, I worked alongside Art History Professor Ellen Hoobler on a project that involved looking at artifacts from ancient Mexican tombs in new ways by incorporating 3D digital modeling and 3D printing. We were able to measure, photograph, and video record a tomb and the remains of the structure on top of the tomb at the archaeological site of Monte Albán, Oaxaca, in southern Mexico. We also visited a community museum near the site and shared some of our printed objects. By 3D printing objects from the tombs, particularly Tomb 104, the physical juxtaposition of ritual objects has allowed us to begin to reconstruct ancient Zapotec rituals. I will suggest that the act of being able to physically experience the scale, size, and shape of objects through the 3D-printing medium contributes substantially to our understanding of the rituals and the spaces in which they were carried out, without any wear and tear on actual objects. We accomplished this using Maxon Cinema 4D software and 3D printing using the Makerbot Replicator and the CubePro, two 3D printers Cornell College's library owns. Many other ritual spaces, whether offering caches or tombs, might benefit from the same kind of replication and investigation. Using Dr. Hoobler's previous archival research data, we reconstructed artifacts that had been excavated in the 1930s, helping to add a significant new dimension to existing knowledge about this ancient site.

**Johnathan Hilliard, '18**

*Classics*

**Montgomery, IL**

*John Gruber-Miller*

## **Evolution of the European Dome**

Beginning with ancient Rome, domes became the design that opened up buildings, creating vast interior space. However, this was an engineering challenge and innovation for the time. Taking the traditional flat roofs of the Classical period and forming a hemisphere high off the ground, made of heavy concrete that is supported only by material below it, the Romans had to adapt to find a way to support the weight. Once the Roman engineers discovered how to displace the stress through a combination of recesses and coffers, they built the world's largest unreinforced concrete dome, the Pantheon. Minor improvements were made over time, but the engineers kept the style relatively close to the original design; although, the art was lost after their eventual fall in the fifth century.

Then, in the fifteenth century, Italian architect Filippo Brunelleschi undertook the task of rediscovering the lost art of dome-building, and sparked a new interest and furthered the art in his own right by completing the dome atop Florence's Santa Maria del Fiore. He redesigned the art and redefined the process for building a dome by creating one from an octagonal base, and made significant changes in supporting the dome above a wide-open expanse, in addition to replacing the iconic oculus of the classical domes with a lantern. In the following century, Michelangelo brought Brunelleschi's accomplishment back to Rome, and was tasked with increasing the size and finding a way to include a new element into the dome: arched windows around its drum, the location where the curved roof meets the walls of the structure. Once completed, the dome above St. Peter's Basilica was the tallest of its kind and the most ornate.

In the presentation, I will examine the design strategies and the materials that the architect and engineers of the Pantheon used to build the monumental dome, the largest of its kind before the Renaissance, and then how the Renaissance architects reinvented the strategies in the case of Florence's Il Duomo and St. Peter's Basilica in Rome.

## **ETV5, an Ets Family Transcription Factor, is a Marker for RAS-Dependent Papillary Thyroid Cancer**

*BRAF*<sup>V600E</sup> mutation has a significant association with tumor recurrences in patients with papillary thyroid cancer (PTC), reducing survival rate from 98% to 40%. Patients treated with *BRAF*<sup>V600E</sup> inhibitors, such as vemurafenib, acquire resistance to the drug over time (6 months) and tumor cells metastasize to distant organs, leading to patient death. Within the group of patients with *BRAF*<sup>V600E</sup> tumors, there are no reliable biomarkers to predict local or distant recurrences, especially when tumors acquire clonal resistance due to the effects of targeted therapies. PTC patients with the *BRAF*<sup>V600E</sup> and RAS mutations show an elevated ETV5 (Ets-transcript variant 5) expression. ETV5, a transcription factor, is known to promote epithelial to mesenchymal transition (EMT) in endometrial carcinomas and ovarian cancer by up-regulating ZEB1, a repressor of E-Cadherin, causing cell detachment and invasion. ETV5 also induces the expression of matrix metalloproteinase 2 (MMP-2) in human endometrial carcinomas, causing invasion.

We hypothesize that ETV5 drives cell proliferation and EMT in advanced papillary thyroid cancer. We used the cell line KTC1 (*BRAF*<sup>V600E</sup> mutant thyroid cancer cell line) as a model. ETV5 and *BRAF*<sup>V600E</sup> were knocked down using Silencer Select siRNA. Alternatively, cells were treated with standard pharmacological inhibitors (i.e. PI3Ki, AKTi, vemurafenib, ERKi, TGFBR1i). ETV5 expression was quantified using quantitative PCR and western blots. Proliferation/growth assays were performed for 5 days and the cell numbers were counted using the IN Cell 6000 confocal system and image analysis software post-transfection/treatment. Knockdown of ETV5 and/or *BRAF* decreased KTC1 cell proliferation. Cell growth was reduced upon treatment with vemurafenib, or PI3K-AKT and ERK inhibitors, but not with TGFBR1 inhibitors. In comparison to DMSO treatment (control), ETV5 levels were down-regulated upon ERK inhibitor treatment, but were increased when treated with PI3K inhibitors. Short-term vemurafenib treatment (48h) showed a reduction in ETV5, N-Cadherin, and CXCR4 expression, suggesting its role in EMT. In conclusion, ETV5 acts downstream of the RAS-MAPK (ERK1/2) pathway, is crucial for KTC1 cell proliferation, and may play a role in EMT in PTC.

Nguyet-Minh Hoang, '16  
*Chemistry*

Ho Chi Minh City, Vietnam  
*Craig Teague*

## Quantifying Physical Changes of Growing Plant Roots

The mechanisms by which microbes affect plant health remain unclear. Some microbes promote plant growth by stimulating root proliferation. Increases in the number of roots foster plant growth by taking up more nutrients and water. Root growth depends on two processes: cell expansion and cell production. Physical characteristics of cell walls, such as elasticity, affect cell expansion via turgor pressure inside the cell. Increases in cell wall elasticity are thought to occur through selective wall loosening, but this process remains poorly understood. *Arabidopsis* infected with *Pantoea* sp. YR343, a symbiont which can colonize plant roots, shows an increase in the number of lateral roots. To understand this process, this study hypothesized that *Pantoea* sp. YR343 secretes auxin, a plant hormone that is involved in root growth, upon colonization of *Arabidopsis* roots, which triggers changes in cell wall elasticity and eventual growth. To test this hypothesis, live *Arabidopsis* roots were mounted and imaged using tape or a gelatin matrix (0.1% (w/v)). Root elasticity in growth media, in auxin (1.0  $\mu\text{M}$ ), and in the presence of YR343 was quantified by atomic force microscopy. Non-treated controls confirmed that the root elasticity decreased and the variation in elasticity increased further away from the root tip. Upon auxin treatment (72 h), the number of lateral roots increased and root length decreased compared to non-treated controls; the elasticity decreased at the root tips, while the elasticity increased farther away from the root tips. This study concluded that auxin treatment causes the elasticity to decrease at the root tip and to increase farther away from the root tip, resulting in the inhibition of root elongation and promotion of lateral root development.

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Kean Johansen, '19  
N Nguyen  
*Mathematics & Statistics*

Minneapolis, MN  
2  
*Tyler Skorczewski*

## The Three-Body Problem

The three-body problem is a classic problem in physics and applied mathematics and concerns determining the motions of three bodies who each mutually influence the motion of the other two through the force of gravity. As simple as the problem may initially appear to be, with only 3 bodies and 1 type of force, Newton, Kepler, and hosts of other great physicists and mathematicians interested in the motion of celestial bodies could not crack this problem and restricted themselves to the simpler case of two bodies. It wasn't until 1887 that Poincare, as part of a contest proposed by the King of Sweden, finally showed that there is no analytical solution to the general three-body problem. So what makes things so much more chaotic by adding one more body to the equation? In this presentation, we will explore this problem and why it is so much more complex than meets the eye.

**Yolanda Jones, '16**  
*Chemistry*

**Portland, OR**  
*Craig Teague*

## **A Study of Solution-Processed Porous Alumina Films**

Mesoporous thin films have a number of possible applications, most notably arising from their insulating properties for use in microelectronics. In this work, we created thin films using a bench-top solution-process method. In order to assess the viability of these alumina films for porous material-use porogens, pore originators made from organic materials were introduced into the  $Al_{13}$  precursor solution. The solutions were then used for spin coating in order to form thin films on silicon substrates. To determine the effect of the addition of these organic materials, the thin films were characterized by measuring film thickness, indices of refraction, and pore size.

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**Bethany King, '16**  
**Nguyet-Minh Hoang, '16**  
**Thao Luu, '16**  
*Biochemistry & Molecular Biology*

**Cedar Rapids, IA**  
**Ho Chi Minh City, Vietnam**  
**Ho Chi Minh City, Vietnam**  
*Jeff Cardon*

## **Dependence of TOR-ts Phenotype on Solid Medium**

The purpose of this research was to analyze cellular growth and glucose metabolism of yeast in various environments as controlled by the TOR2 pathway. TOR2 is a central metabolic regulator involved in cellular growth and proliferation. TOR2 regulates protein synthesis by regulating translation and mediating early  $G_1$  progression of the cell cycle. TOR2 is involved in mediating the cell-cycle-dependent polarization of the actin cytoskeleton. Disruption of the TOR pathway is implicated in many pathological disorders, and a great deal may be learned from the inner workings of this pathway.

In this research, a TOR2 mutation that causes cells to spontaneously arrest in the  $G_1$  phase of the cellular cycle at the restrictive temperature of  $37^\circ\text{C}$  was compared to wild type. The mutant growth phenotype is not appreciated in liquid culture as discovered by previous research (Norton, 2015). Cellular growth in incremental agar concentrations was analyzed. Yeast was cultured on agar plates to investigate growth as a function of agar concentration as the medium varied from solid to semisolid.

Although the mutation was not rescued in the agar concentrations studied, this research led to modified and improved extraction techniques of yeast colonies for increased reliability of analysis. Evidence from this study suggests that the Vicell is a reliable counting method and was verified against known standards (Beckman Coulter, 2015).

This research continues with the comparison of yeast growth in various environments and increased study into cellular utilization of glucose.

## **A Two-Dimensional Study of Fish Benthic Feeding with Suction**

Fish employ multiple techniques in order to capture and consume their prey, including using suction. This is done by the fish rapidly expanding their buccal cavity (the inside of the fish's mouth, from the tip of the jaw to the back of the throat), which creates a volume drop inside their mouth that causes water and the prey to be sucked into the fish's mouth. When examining a fish feeding, a metric is needed to measure its performance; for this study, the time that it took for the center of mass of the prey to cross the fish's jaw tip was used as a metric. To begin understanding the ability of the fish, it was tested in an open-water system. In this system, the fish was feeding off of a simple circular prey, which could approximate a fish egg, at varying distances. In the literature, a fish is able to suction feed at a distance roughly equal to its maximum gape width. With the range of ability for the fish to feed being used, simulations were designed to evaluate the optimum parameters at which the fish fed. Also, in the open-water system, the prey was changed to a triangular prey to represent a limpet and the same factors were tested. The system was then changed to a tank-like system. This allowed for the fish's ability to feed off of prey that were on the seafloor to be tested. The prey was then given the ability to attach itself to the surface of the tank to model the escape mechanism of the limpet. This was to model a situation more closely representing a realistic scenario.

## **Using Bioinformatics to Identify Immune System Genes in True Fruit Flies: A Step Towards Preliminary Probe Design**

*Blepharoneura* is a genus of cryptic, Neotropical, South American fruit flies in the Tephritidae family involved in amazingly specific interactions with their parasitic wasps (Condon et al. 2008). Most of the species of parasitic wasps can kill only one species of fly. If the wasps attack the "wrong" fly, the wasp dies (Condon et al. 2014). Current research aims to discover the mechanisms that explain and maintain such incredibly specific lethal interactions and how these relationships evolved. The purpose of my research was to establish a database of tephritid immune system genes that, when sequenced through Anchored Hybrid Enrichment (AHE) (Lemmon et al. 2012), could reveal evolutionary patterns associated with the known parasite-host relationships and be used to test hypotheses about the genetic and molecular mechanisms governing host survival. Some of these genes may be homologous with genes known to be involved in immune function in *Drosophila* (common fruit flies). Previous research into the cellular immune response in *Drosophila* has identified 144 immune system genes shown to be upregulated in response to parasitic attack (Wertheim et al. 2005, Schlenke et al. 2007, McQuilton et al. 2012, Salazar-Jaramillo et al. 2014). Little is known, however, about the cellular immune response in tephritid flies. Using extensive data mining (NCBI, FlyBase, OrthoDB) and premier bioinformatics software (MEGA 6, Geneious), I established a database of 56 single-copy orthologous genes in eight Tephritidae species for preliminary AHE probe design. To top off the project, I ran a phylogenetic comparison (RAxML) of the eight tephritid species using the concatenated protein sequences of 22 immune system genes from my database. The resulting phylogenetic tree (recalculated 500 times) adhered to the current understanding of Tephritidae phylogeny in scientific literature and was supported with high bootstrap values.

**Grace Leppink, '16**

**Conor Moore, '18**

*Biology*

**Falcon Heights, MN**

**Somerset, CA**

*Andy McCollum*

## **Growth and Home Range of Juvenile Ornate Box Turtles**

The ornate box turtle (*Terrapene ornata ornata*) was once widespread and common in eastern Iowa, but the conversion of native sand prairies to agriculture has dramatically reduced the range of the now-threatened species. In the summer of 2015, this research contributed to a 23-year study on ornate box turtles by investigating the growth, movements, and home range sizes of hatchlings and juveniles in a population in Johnson County, Iowa. The study fixed small radio transmitters to hatchling and juveniles and then monitored their locations and habitat associations. Using three years' worth of morphological data, researchers determined relationships between size characteristics and age. The home range data revealed as the hatchling and juvenile turtles aged, their home ranges generally increased and their habitat diversified. Three size characteristics: plastron length, carapace length, and mass, when plotted, showed a steady increase over time, with a plateau when the turtles reach maturity.

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**Grace Leppink, '16**

*Biology*

**Falcon Heights, MN**

*Andy McCollum*

## **Macro-Fungi Diversity Survey of Primary, Secondary, and Coastal Forests on the Osa Peninsula**

Many people are familiar with and appreciate plants and animals, which are ecologically important as primary producers and consumers, respectively. Fungi are perhaps less appreciated, but no less important ecologically, serving a major role, along with bacteria, as decomposers essential to the cycling of nutrients on which both plants and animals depend. To quantify plants, animals, and fungi is important for biologists and conservationists. Biodiversity surveys are useful for comparing restoration sites to reference sites. On the property of Osa Conservation, a nongovernmental conservation organization on the Osa peninsula, Costa Rica, I conducted a survey of macro-fungi. The major goal of the project was to provide the organization with quantitative information on the diversity of macro-fungi in three habitat types on their property: coastal forest, secondary forest, and primary rainforest. In total, four transects were completed in each forest type for aboveground macroscopic fungi by photographing all fungi found along each transect and documenting the substrate on which each grew. The findings were contrary to expectations, with the coastal forest having the highest diversity index and the primary rainforest having the lowest index.

Thao Luu, '16

Ho Chi Minh City, Vietnam

*Jeffrey Cardon*

## **Sudden Unexpected Death in Epilepsy and Probable Obstructive Sleep Apnea**

Sudden Unexpected Death in Epilepsy (SUDEP) is estimated to cause approximately 2,000 deaths in the USA every year (Massey et al., 2014) and is the major cause of death in individuals with refractory epilepsy. Since most SUDEP cases have been found in bed, there has been a great deal of effort trying to investigate the comorbidity of sleep and epilepsy.

The goal of this exploratory study is to assess the association in 49 epilepsy adult inpatients between probable Obstructive Sleep Apnea (OSA) and the seven risk factors of SUDEP established in the SUDEP-7 Index (DeGiorgio et al., 2010).

Forty-nine adult patients with epilepsy who were admitted to the Mayo Clinic Comprehensive Epilepsy Program inpatient monitoring unit with focal, generalized, or unclassified epilepsy syndromes were included. Probable OSA was identified using overnight oximetry; the Sleep Apnea—Sleep Disorder Questionnaire; and STOP-BAG, which provides predicted scores for OSA using Snoring, Tiredness, Observed breathing pauses, Pressure too high, BMI > 35 kg/m<sup>2</sup>, Age > 50, and Gender = male. Statistical calculations were carried out using JMP Version 9 (SAS Inc., Cary, NC).

A statistically significant association ( $p = 0.005$ ) was found between patients with higher SUDEP-7 scores (of median 3 and above) and those with probable OSA as diagnosed by the Oxygen Desaturation Index data. Statistical analyses with other measures for probable OSA also showed either a positive correlation or a trend toward association between SUDEP-7 scores and probable OSA variables. Further studies are needed to confirm whether OSA is a potential SUDEP risk factor so that we can take appropriate measures in treating epilepsy patients with OSA.

## **Development of a High-Throughput Catalase Assay to Test Botanical-Based Peptides**

Pulmonary hypertension is a potentially fatal disease that has been shown to be caused by an imbalance of reactive oxygen species and antioxidant defenses, causing vasoconstriction and abnormalities in the vascular wall. In many studies, the use of antioxidants as a therapeutic treatment has been capable of attenuating the oxidative stress that causes the progression of pulmonary hypertension. Recent screenings of botanical peptides identified peptides that promote the activity of free radical scavengers, such as superoxide dismutase and other compounds with similar properties. Another antioxidant enzyme, catalase, works in conjunction with superoxide dismutase to protect cells by decomposing hydrogen peroxide into water and oxygen. Further research into the free radical scavenging properties of botanical peptides and their similarities to catalase could be used to develop a potential treatment option for pulmonary hypertension. The challenge to studying the corresponding characteristics of catalase and botanical peptides is to find a test that would not only examine the properties of botanical peptides, but would also evaluate multiple samples at once. An additional, high-throughput assay was developed and validated for the purpose of evaluating antioxidant activity similar to that of catalase in botanical peptides. The botanical peptides tested could then be examined in cell and animal models in order to develop a nutraceutical for pulmonary hypertension.

## **The Sound of the Desert: Experiences with Music in the Middle East**

Music is an integral piece of a society, and in order to fully understand the local community as a foreigner, it's important to look into the cultures and customs involving music. The transformation of the Middle East is best understood through the music which has accompanied change. The past hundred years have been particularly telling, as music was not encouraged during the 600-year rule of the Ottoman Empire. While studying abroad in Amman, the capital of Jordan, I decided to try my hand at a new instrument. I chose the oud, a classical Arabian lute, predecessor to other familiar stringed instruments such as the guitar. I was able to create an independent project focusing on Middle Eastern music and, in particular, the oud.

This presentation frames my own journey into the music of this ancient region and learning to play the oud in this unique setting. I will provide background on the history of the instrument, as well as the transformation in the past hundred years of the oud. I will also briefly discuss the difference between the scales and modes of Middle Eastern music and those of Western music. The presentation will be accompanied with stories of my experiences in the pursuit of music in the Middle East, discussing people and places that made an impact on my studies. Whether it was in the traditional setting with the Bedouin in Wadi Rum or in the high-class modern neighborhood where I took lessons, the oud is a staple of Middle Eastern society and my own experiences in the Middle East.

**Laura Michelson, '16**

*Medieval & Early Modern Studies*

**Mount Vernon, IA**

*Michelle Herder*

## **Reading Between the Lines: Decoding the Annotator in Early Modern English Marginalia**

In a society and time that was bound by privileges of literacy education, the knowledge, time, and materials necessary to create marginalia were accessible to a narrow population of annotators. What can be gleaned from marginalia is a sense of annotators from an individual level to a composite scope informed by the larger context of a cultural moment and its philosophies of the act of reading. A microcosm of an individual annotator and his or her interactions with a work in a study as unique and variable as marginalia speaks to a larger cultural moment. To be well read and familiar with the classical canon was an essential part of being a courteous scholar. Through marginalia, an opportunity to immerse in peripheral marks of early modern readership presents itself. In the margins of books, traces of past readers reflect aspects of themselves, their occasions and motivations of reading, and the context of their social and historical moment.

This study focuses on five primary sources. These titles may abstractly be linked through the possibility of them having passed through the hands and social circles of aspiring scholars, gentlemen, and courtiers. An abstract early modern English library can be substantiated by the vast variety of topics between books that would have fallen into an ideal reader's possession. The early modern annotator attempted to justify through the practice and fashionable practice of annotating their belonging to the class of the educated and well read. Although the majority of the annotators in this study remain anonymous, the identification of one prominent annotator—Gabriel Harvey—illuminates an understanding of early modern marginalia and the annotators who left their mark on a page.

## **The Speed of Modernity in Harold Lloyd's *Safety Last* (1923)**

I will be examining *Safety Last*, an American silent film by the distinguished director Harold Lloyd. Lloyd was one of the most significant filmmakers of the silent film era. He was known for creating dangerous stunts in the majority of his popular films. His cinematic choices in a few scenes exemplified larger issues about the thrilling, and sometimes terrifying, experience of life in the Roaring Twenties. There are various themes portrayed throughout the film; bravery and love are the most apparent. The transitions between scenes reflect the central theme of time. The surface of the film *Safety Last* projects Harold's love, self-sacrifice, and dedication to his beloved Mildred. Through comedy, Lloyd reveals a contrasting tone of war, economics, and fear. A close analysis of Harold's swing from the clock like a pendulum creates a sense of fear for the audience. Harold uses time to reveal the greater correlation to post-World War I consumer society in America and the importance of finances during that time. The shots that I will be closely examining come from the thrilling finale of the film, and capture the sentiments prevalent throughout it. Harold Lloyd incorporates reality and fiction with a blanket of comedy. Although this correlation is not apparent when first watching the film, my analysis of the last few shots are critical to understanding the time period in which the film was shot. The last few minutes are critical to understanding Harold Lloyd's artistic taste in filmmaking. His euphemistic approach to strenuous matters allows society to view his art in a different light.

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## **Parkinson's Disease and Melanoma: Using Zebrafish to Explore the Roles of Ion Channel TRPM7 in Dopamine Neurons and Melanocytes**

Parkinson's Disease (PD) is second only to Alzheimer's disease as the most common neurodegenerative disease in humans, and individuals with PD are at a higher risk of developing melanoma. African Americans have a lower incidence of PD and present with symptoms at an older age than Caucasians, suggesting a relationship between skin pigmentation and PD. In addition, highly pigmented individuals may be making more of the precursor to dopamine, L-dopa, that is used to treat PD, explaining the delayed onset of PD. A zebrafish model was used to investigate the hypothesis that rescuing melanocytes in a zebrafish mutant without pigmentation and with a movement disorder would result in an increase in endogenous production of L-dopa and restore movement. One-cell embryo mutants were injected with a plasmid containing a melanocyte-specific promoter (microphthalmia-associated transcription factor, *mitf*) which controls production of melanin within melanocytes and a gene lacking in the mutants that is involved in movement (transient receptor potential cation channel 7, *trpm7*), thereby potentially restoring both the pigmentation and movement in the mutant fish. Embryos (48 hours post-fertilization) were observed for rescue of melanocytes and a movement assay was conducted. Embryos were genotyped to confirm presence of *mitf* plasmid. Partial rescue of melanocytes was seen in *trpm7/mitf* generation-zero zebrafish. No significant movement difference was seen in *trpm7/mitf* transgenic animals in comparison to *trpm7*<sup>-/-</sup> mutants.

Kayla Morton, '16  
*Russian*

Cincinnati, OH  
*Lynne Ikach*

## Shadows of the Outer Worlds: A Transformation of *Dead Souls* from Verbal to Pictorial Art

“Art instills harmony and order into the soul, not confusion and disorder”- N.V. Gogol. Although Gogol made this statement, his work *Dead Souls* is disorderly and leaves the reader wondering ‘What did I just read?’ It is because of this question that many scholars and critics have interpreted the work in a variety of ways. A labyrinth of disarray and disorder, Gogol’s novel *Dead Souls* leaves its audience in a state of confusion and shock.

While there is confusion about the meaning of the work, critics agree that Gogol’s artistic methods are non-conventional. In this presentation, I will describe how Gogol uses the “estrangement” technique to make the familiar unfamiliar. A discussion of this technique, along with an analysis of his use of light imagery and exaggeration, will enlighten the audience on how Gogol presents the absurdities of life and refreshes the reader’s own reality.

In addition, I will present a series of illustrations I created that were inspired by the novel. Through my reinvention of the aesthetics of the characters, the audience will understand the visual power of Gogol’s work.

The audience will be able to gain insight on the artist’s process in creating the characters of *Dead Souls*, along with scenery. The characters who have complex stories of life and its struggles speak to us on a universal level, but they also paint a picture of Russian comedy and satire rarely seen by foreigners.

This talk shares the beauty of Gogol’s pictorial art within *Dead Souls*, along with sharing original artwork inspired by the work.

## **Linkages between Rapid Creek and Putnam Watersheds for Determining Conservation Efficacy**

Nitrates and other farm chemicals are transported from farmers' fields into nearby streams. Nitrate levels have grown so high that they are likely the cause of hypoxia (lack of oxygen) in the Gulf of Mexico. Although methods to control the spread of farm chemicals have been implemented, it can be hard to determine if these efforts are effective due to the large number of variables associated with contaminant transport in water. Therefore, one method of determining effectiveness is to identify paired watersheds. A watershed is an area where all rainfall runs into a single stream or river; paired watersheds are two watersheds that respond similarly to climatic events. Implementing interventions on one watershed allows any changes seen between the two watersheds to be attributed to the conservation techniques. In order for this method to be effective, a strong link must exist between the two watersheds in question. In this study, two watersheds in Iowa, Rapid Creek and Putnam, had sensors installed near the mouth of each respective stream that took readings every five minutes for nine months, measuring nitrate, pH, temperature, and turbidity (particles suspended within water). These measurements, along with rainfall data, were compared to determine if both watersheds followed the same patterns. Preliminary results suggest that Rapid Creek and Putnam are indeed paired watersheds ideal for conservation studies.

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**Aeint Thet Ngon, '16**  
**Dawit Tsigie, '16**  
**Jacob Cuellar, '16**  
*Economics & Business*

**Yangon, Myanmar**  
**Addis Ababa, Ethiopia**  
**Loves Park, IL**  
*Aaron Miller*

## **Diagnostic Errors in Pulmonary Embolism**

The objective of this study is to identify misdiagnosis of pulmonary embolism and other factors that might be related to misdiagnosis using a data-driven approach.

We used the HCUP database of inpatient and emergency patient information in New York and California between 2005 and 2012. There were 64,382,957 observations in New York (20,926,038 inpatient and 43,456,919 emergency patients). There were 92,561,453 observations in California (27,907,535 inpatient and 64,653,918 emergency patients). We looked at patients diagnosed with pulmonary embolism and their previous and subsequent visits, as well as 10% of randomly-selected non-pulmonary-embolism patients.

Cancer, heart diseases, and physical injuries that cause immobility are very common in pulmonary-embolism patients. Having a low socioeconomic status; being a member of minority races such as Native American, Black, and Asian; a weekend admission; and discharge against medical advice are highly associated with a misdiagnosis. The less a hospital sees a pulmonary embolism, the more likely the physicians are to misdiagnose.

Using a data-driven approach, we accomplished the objective we set out for this project and we confirmed the hypothesis we had about misdiagnosis. There were limits to our data, but an analysis of more granular data could help us strengthen our results. We could also use a classification tree to create rules and warnings to reduce the number of misdiagnoses.

## Elasticity of Household's Demand for Distributed Solar Energy in Southern California

The method in which electricity is produced in industrial-sized, centralized facilities and distributed to users through power grids has been the main electricity-generation method in the US for a long time. Yet, given that a lot of the grids are currently out-of-date and expensive to be upgraded, as well as the fact that the solar energy sector has grown dramatically over the past years, more and more attention has been given to distributed solar power generation. Under this method, individual residential and commercial units can adopt rooftop solar panels to generate electricity on their own without having to rely solely on electricity from the centralized power grids. One interesting question to ask is about the elasticity of the demand for distributed solar energy with respect to some factors that could impact individuals' decisions to adopt this form of energy, such as the incentive amount, income, and the price of utility-generated electricity. In other words, how responsive is demand for electricity generated by solar panels to changes in those factors?

Using data from the California Solar Initiatives in 2013, I estimate the elasticity of demand for distributed solar energy with respect to the price of utility-generated electricity, the price of electricity generated by solar panels and the solar incentive amount that each solar panel owner received. The research focuses on Los Angeles, Orange, San Bernardino, San Diego, and Riverside counties, the five southern counties with the most amount of distributed solar energy generated in California in 2013. My findings reveal that demand for distributed solar energy, as reflected through the amount of energy produced by solar panels, is elastic with respect to the solar incentive amount, and that the elasticities with respect to the price of utility-generated electricity and the price of electricity generated by solar panels vary according to different model specifications.

## Computational Study of Interactions between CO<sub>2</sub> and Free Anions

Carbon dioxide capture is of great importance for chemical research due to carbon dioxide's potential as a greenhouse gas. Ionic liquids have been suggested as possible alternatives to traditional aqueous amine solutions currently used for capture because ionic liquids can absorb more CO<sub>2</sub> per mole and because lower desorption energies can be achieved. Previous computational work has shown that the presence of electron-withdrawing substituents on phenolate and cyclohexanolate ions decreases the interaction energy of CO<sub>2</sub>. Using density functional theory, we sought to understand what effect other electron-withdrawing or electron-donating substituents would have on the interaction energy of phenolate- and cyclohexanolate-derived anions. We calculated the energies associated with the interactions between CO<sub>2</sub> and various substituted cyclohexanolates and phenolates to observe the correlation between ring structure, bond length, and reaction energy. Partway through our research, we became intrigued by other research on SO<sub>2</sub> capture showing high molar ratios of SO<sub>2</sub> to ionic liquid. Thus, we calculated the energies of a CO<sub>2</sub>-anion interaction for various amine- and phosphine-functionalized anions, in an attempt to understand the possibilities of greater than a 1:1 molar capture ratio of CO<sub>2</sub> to ionic liquid.

**Anh Pham, '16**  
**Polina Duneva, '18**  
*Economics & Business*

**Hanoi, Vietnam**  
**Moscow, Russia**  
*Aaron Miller*

## **Identifying Diagnostic Errors in Healthcare Using Data Analysis**

Misdiagnosis is the leading cause for malpractice in healthcare and can result in improper treatments, disabilities, or death. Misdiagnoses have become increasingly more expensive as healthcare reimbursement shifts to a quality-based system. Endocarditis, an infection of the inner lining of the heart, is one of the more prevalent misdiagnosed diseases, and results in severe health complications as the infection spreads throughout the body. The objective of the study is to identify factors which might be associated with endocarditis diagnostic errors and deliver a proposal for specific areas of interest for future study.

Using inpatient and emergency department databases from the Healthcare Cost and Utilization Project (HCUP) data for California and New York between 2005 and 2012, we identify all patients who were diagnosed with endocarditis. We then link all visits of those patients that fall within a 60-day window—an approximation for the plausible progression of endocarditis development. We create a list of symptoms and diagnoses indicative of endocarditis and define patients with these primary diagnoses as having a missed opportunity to diagnose the disease. We then use statistical methods to identify common factors for these patients that might influence the probability of endocarditis misdiagnosis. Our goal is to predict patients with endocarditis diagnosis errors, or at the very least, identify factors which significantly impact misdiagnosis.

There are 10,498 patients in California and 7,773 patients in New York with plausible misdiagnoses, meaning they have a visit within 60 days of being diagnosed with endocarditis. Using statistical tests, we found a set of significant factors which are common among endocarditis patients suspected to be misdiagnosed. They align with the known symptoms of endocarditis, such as bacterial infections, prior heart defects, fever with unknown origin, etc. Twenty-five to seventy-four percent of patients with plausible misdiagnoses were diagnosed with at least one of the factors in our selected set of characteristics. The regression test confirmed that our suspected patients are more likely than other cases to reflect these factors.

We have implemented a data-driven approach to indicate demographic variables and medical conditions which affect the rate of misdiagnosis. Moreover, looking at patients' records, it is likely that several of our statistically-identified factors may have serious diagnostic implications, which can be fully explored with future study. Various types of dispositions of the patient at discharge, and their race, sex, age, and length of stay at the hospital may be useful indicators to a doctor before he or she determines a patient's final diagnosis.

Meghan Powers, '16  
Ruby Linkhart, '16  
Shuhan Reyes, '16  
Sol Wooten, '17  
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*Psychology*

Wilton, IA  
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Seattle, WA  
*Melinda Green*

## **Effect of a Dissonance-Based Eating Disorder Program on Cardiac Risk Indices, Objectification, and Maladaptive Social Comparison**

We conducted a randomized, controlled preliminary trial of a dissonance-based eating disorder prevention program in a community sample of women with clinical and subclinical symptoms.

Verbal, written, and behavioral exercises designed to dissuade objectification and maladaptive social comparison were added to the traditional content of the *Body Project* prevention program. Program efficacy was compared to an assessment-only control condition. Body dissatisfaction, self-esteem, self-objectification, thin-ideal internalization, maladaptive social comparison, trait anxiety, eating disorder symptoms, and biomarkers of cardiac risk were evaluated in 52 participants. With regard to cardiac indices, we assessed mean R-wave amplitude, QT interval length, vagal tone (high-frequency spectral power of heart rate variability), and sympathetic tone (low/high-frequency spectral power ratio) via electrocardiography (ECG) at each assessment period. All measures were examined in dissonance and assessment-only control conditions at baseline, postintervention, and 2-month follow-up.

We predicted a statistically significant 2 (condition: control, dissonance) x 3 (time: baseline, postintervention, 2-month follow-up) interaction in the mixed-factorial MANOVA results for participants (N=47) in regard to eating disorder symptoms. Results confirmed this hypothesis. Eating disorder risk factors and symptoms decreased significantly among participants in the dissonance condition at post-intervention and 2-month follow-up compared to baseline; symptom improvement was greater among dissonance compared to control participants. We also predicted a statistically significant 2 (condition: control, dissonance) x 3 (time: baseline, postintervention, 2-month follow-up) interaction in the mixed-factorial MANOVA results in regard to participants' cardiac risk indices. Results also confirmed this hypothesis. Cardiac risk indices decreased significantly among participants in the dissonance condition at postintervention and 2-month follow-up compared to baseline.

Results provide support for the efficacy of a dissonance-based program in the reduction of eating disorder symptoms and cardiac risk indices among women with subclinical and clinical eating disorder symptoms. Findings extend the efficaciousness of the dissonance-based approach to treatment and tertiary prevention and establish its effectiveness in reducing cardiac risks.

Sean Quick, '16  
*Geology*

San Rafael, CA  
*Emily Walsh*

## **Elemental Zoning Analyses in Eclogitic Garnets from the North Qaidam UHP Metamorphic Belt: Testing Trace Element Zoning Models and P/T Path**

Trace elements, including the rare earth elements (REEs) and Y, constitute low concentrations (<0.1%) of bulk rock compositions. These elements do not control growth, but instead record metamorphic events through zonation patterns in garnets. For example, heavy rare earth elements (HREEs) tend to be concentrated in the core of the garnet because they are preferentially incorporated by garnet early in its growth. This is known as a bell-shaped distribution pattern. Light rare earth elements (LREEs) are larger and cannot be as easily incorporated into the garnet structure. This study also examined major mineral zoning for Ca, Fe, Mg, and Mn in garnets, as well as analyzed accessory-phase minerals apatite, monazite, xenotime, allanite, zircon, titanite, and rutile to predict REE patterns and help refine the trace element analysis. Major element maps were created using the JEOL JXA-8230 Superprobe at the University of Iowa using an accelerating voltage of 15 kV and a 100-nA beam current, with a dwell time of five seconds. Accessory mineral data for the current study were gathered using a variable-pressure 5-3400 Scanning Electron Microscope (SEM) with a beam voltage set to 15 kV and a vacuum setting of 6. Analysis of major element maps and accessory mineral data revealed the North Qaidam ultrahigh-pressure terrane was heated during exhumation, underwent prograde metamorphism, and experienced mineral growth during decompression. Based on the accessory minerals, it is expected for future studies that the garnets will display a bell-shaped distribution pattern for Y and M-HREEs while LREE concentrations will be high.

Belou Quimby, '19  
Marin Dettweiler, '19  
Julia Eastham, '19  
Camden Grundeman, '19  
*Biology*

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Naples, FL  
*Tammy Mildenstein*

## ***Betta splendens* Aggressiveness in Variations of Water Temperature**

The effect of global climate change on the performance of living organisms has not yet been thoroughly researched. The purpose of this study was to understand how these temperature variations would affect organismal behavior. After discovering how important it is for fish to live in specific water temperatures due to oxygen levels, these organisms became a major concern. In need of a fish whose behavior is easily noticeable, it was decided to focus on the aggression of *Betta splendens* in variations of water temperature. An experiment that used six fish, three water temperatures, and controlled fish fights was created. Two fish were placed in each tank with a transparent divider, allowing them to see each other and fight without coming into physical contact. They were engaged in bouts three times a day with heat lamps at different angles, mimicking the movement of the sun, to achieve data as similar to natural settings as possible. All of the data were collected over the course of ten days and were averaged out by day. The data were then compared to determine if there was any difference in their behavior between the temperatures. This short-term experiment showed that the fish demonstrated more aggression in both warmer and colder water compared to their normal temperatures. Suspecting that these same results would be shown through experimentation with other species, we hypothesize that there would be major impacts on the planet due to having more hostile animals. The economy of many countries would crash due to their intense usage of the affected bodies of water, and the ecosystems all around the world would go out of balance due to natural selection.

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Katelynn Raney, '16  
*Politics/Economics & Business*

Albuquerque, NM  
*David Yamanishi*

## **The Effectiveness of Human-Resource Focused Charities in a Market with Government Labor-Training Alternatives**

In the United States, the nonprofit sector has grown steadily to reach 1.44 million registered organizations as of 2014, which contributes an annual average of 5.4% of gross domestic product in the United States. The sector is incredibly diverse and dynamic, yet studies measuring the impacts of their programs are scarce past financial data, or they focus specifically on individual case studies within specific “types” of nonprofits (such as art or religious institutions). As of yet, this same research does not exist to explain the impact of nonprofits that provide labor training to the unemployed, nor does it provide an effective and widely-applicable assessment of nonprofit organizational effectiveness. In my work, I explore the research and theories behind nonprofit labor-training initiatives as a vehicle for poverty reduction and whether or not they have a more substantial impact on long-term structural unemployment, market wide, compared with the Department of Labor’s Education and Training Initiative. This work seeks to create a survey assessment that can be applied to any nonprofit strategic plan in order to develop a metric for econometric analysis. By exploring the intersection of economic theory, political theory, and research on organizational effectiveness/nonprofit case studies, this presentation seeks to contribute additional insight into what makes an “effective” nonprofit.

**April Richards, '16**  
*Environmental Studies*

**Hanna, WY**  
*Andy McCollum*

## **Invasive Lionfish Management in Belize**

Lionfish, native to the Indo-Pacific Ocean, threaten reef systems throughout the Atlantic Ocean and the Caribbean by eating native fish of economic and ecological importance. In Belize, lionfish management depends primarily on nonprofit conservation organizations and incentivizing fishermen and divers to harvest the lionfish. Lionfish products, including meat sold by restaurants and jewelry made from the fins, create economic demands that encourage fishermen and divers to participate in population control. With the goal of exploring invasive lionfish management from interdisciplinary perspectives, I worked with the nonprofit organization, Reef Conservation International (ReefCI), on population monitoring and control and conducted independent research on the social and economic impacts of the sale and production of lionfish products. With ReefCI, based on Tom Owens Caye, I contributed to marine conservation efforts including lionfish harvesting and analyzing their stomach content, as well as surveys of commercial fish species, lobsters, conch, and coral reef health. On the mainland, primarily in Placencia, I interviewed women who make jewelry from lionfish and the owners and managers of restaurants that serve lionfish about the benefits and challenges of producing and selling these products. One major finding was that restaurants like to sell lionfish and it generates good profits; however, they complained that not enough lionfish are being harvested. This two-part project allowed me to gain a more comprehensive understanding of Belize's lionfish management efforts.

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**Bailey Robb, '16**  
*Philosophy*

**Saint Louis Park, MN**  
*Jim White*

## **Exploring Pragmatic Environmental Ethics in the Amazon Rainforest**

Philosophers reside in their comfortable armchairs atop the Ivory Tower of academia speculating about the nature of the world, seldom venturing downstairs to see how their theories work in the real world. As such, a majority of the work in philosophy is produced at a desk where the authors are removed from the situations they seek to describe, creating a gap between a philosopher's solutions and what can actually be accomplished. Rather than keep with this tradition, my work seeks to explore the boundaries of philosophy by investigating the ways that ethical theories interact with field work in environmentalism. As a Cornell fellow, I studied in the Amazon Rainforest at a conservation nonprofit run by indigenous Amazonians. My goal was to create an ethical framework that incorporates environmental studies and philosophy while being accessible to the average person. The final product is a pragmatic environmental ethic that strives to be as universally applicable as any singular theory can be in philosophy.

## **The Cornered Bear: Analysis of the Justifications behind Putin's Aggressive Foreign Policy**

On February 28th of 2014, Russian soldiers wrested control of a number of key road junctions between Ukraine and the Crimean peninsula, as well as the airport in Sevastopol. Over the next several weeks, Russian military units gained control over the entire peninsula in a relatively bloodless seizure of Ukrainian territory. The spontaneity of the armed occupation of Crimea can easily lead one to the conclusion that the crisis sprung out of a quick, arbitrary decision by land-hungry Russian leaders. To view the events that unfolded in Crimea through this lens provides one with a simplistic interpretation of these events that fails to take into account the numerous conditions which triggered the Kremlin to act in such an aggressive manner. The events surrounding Russia's annexation of Crimea characterize a shift in Putin's regime toward a more aggressive and nationalistic foreign policy, characterized by the frequent use of military force to pursue Russian regional interests, which many consider are under threat. The expansion of NATO into much of Eastern Europe, the involvement of Western human rights NGOs in a number of countries within Russia's orbit, and the construction of a variety of anti-missile installations near Russia's borders have all fed into the perception that Russian sovereignty has come under threat and that the Russian Federation must immediately take drastic measures in order to roll back the threat of foreign encroachment. This paper will examine the relationships between the perceived provocations mentioned above and the decline in relations between Russia and the West, which have triggered the increasingly heavy-handed approach taken by Putin's regime in asserting Russia's international interests.

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Allison Samayoa, '16  
*Biology*

Coolidge, AZ  
*Craig Tepper*

## **Examining the Symbioses between *Millepora* and *Symbiodinium* at Two Thermally Different Locations**

Rising seawater temperatures have increased rates of coral mortality due to bleaching. Bleaching is a result of the loss of *Symbiodinium*, a photosynthetic protist, from coral tissues. Both temperature and light play important roles in the diversity of coral symbionts, and different *Symbiodinium* clades (A-I) provide different physiological benefits to their coral hosts. This symbiosis may provide coral with a mechanism to cope with thermal stress events associated with global warming.

The vast majority of the research examining the coral-*Symbiodinium* relationship has focused on Scleractinian (stony) corals, while ignoring the major reef-framework-building hydrozoan Millepores (fire coral). We are examining the diversity of the Millepore-*Symbiodinium* symbiosis at two thermally different Caribbean reef locations: San Salvador, Bahamas and South Water Cay, Belize. Our preliminary results indicate that sea surface temperature may play an important role in diversity of symbionts residing in Millepores. Clade B was the sole dominant symbiont found in coral colonies (N=28) collected in the Bahamas (northern Caribbean), where sea surface temperatures are cooler. Clade A was the dominant symbiont found in coral colonies (N=20) collected in Belize (southern Caribbean), where sea surface temperatures are slightly warmer. The difference in the dominant symbiont clades present appears to be associated with different environmental conditions at each geographic location and may reflect that the South Water Cay, Belize location is exposed to more frequent thermal stress events.

**Cameron Seebach, '17**  
*Computer Science*

**Glendale, CA**  
*Ross Sowell*

## **Inexpensive Sea Temperature and Wave Energy Studies**

Although data are available globally for the study of sea temperature and waves, the resolution of the data limits the conclusions that can be drawn in small areas and small slices of time. This research presents a novel device designed and constructed for measuring surface sea temperature and wave energy that costs significantly less than competing products and gathers more data. The device uses off-the-shelf electronic components and 3D printing to achieve low cost and high tolerance to marine environments. It will enable small-dollar and undergraduate researchers to conduct meaningful oceanography research and enhance existing techniques for such research.

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**Ryan Shanks, '16**  
*Geology*

**Des Moines, IA**  
*Kelsey Feser*

## **Correlation between the Species Morphology and Paleoecology of *Ceraurus* Genus Trilobites**

The trilobites of the genus *Ceraurus* have always been relatively uncommon. I chose to conduct research on this particular trilobite genus as I feel that the genus has been somewhat overlooked and I believe there is still a lot which we do not know about its members. In this research, I looked at the morphology of specimen from the genus *Ceraurus*, the paleoecological and environmental indications of these specimens, and their variance between species.

For this research, I compiled a number of scholarly sources on *Ceraurus* and collected relevant data and measurements from *Ceraurus* trilobite specimens at The Field Museum in Chicago. From this, I created well-rounded morphological descriptions of the *Ceraurus* specimens, as well as a paleoecological and environmental description of *Ceraurus*' habitats. From analyzing these data, I found that the ratios of cephalon width to genal spine length and the overall frailness/robustness of the exoskeleton in the specimens showed a strong correlation to the paleoenvironment indicated for each relevant *Ceraurus* specimen. I also found that the ratios and paleoenvironmental indications correlated strongly with differences in *Ceraurus* species.

The correlation between *Ceraurus* genus trilobite morphology and difference in species may further correlate with and be the product of the contrasting paleoecologies in which different species of *Ceraurus* trilobites lived. If causal correlations between paleoecology and morphology can be found in other trilobites and potentially even other arthropods, it may open the door for many new discoveries on how these ancient organisms lived and better our understanding of ancient marine life and the effects ecology has on morphology.

Elena Skosey-LaLonde, '17  
*Geology*

Chicago, IL  
*Benjamin Greenstein*

## **17 Years on a Beach: A Comparative Study of Beach Dynamics over Time**

This research compiles beach profiling data obtained yearly between 1999 and 2016 and indicates annual changes in the beach morphology of three beaches on San Salvador Island, Bahamas. The profiles provide a visualization of the effect of different hydrodynamic regimes present on each beach. The beaches surveyed are each affected differently by wind- and wave-energy regimes, resulting from their associated offshore environments and geographical location on the island. Rocky Point Beach is located on the northwestern side of San Salvador and is sheltered from the northwesterly winds and waves associated with cold fronts during the winter season, thus allowing the beach to remain in a relatively stable state since 1999. East Beach, located on the eastern side of San Salvador, is a moderately-low-energy beach, resulting from the presence of an algal ridge 200 meters offshore that acts as a wave breaker. East Beach is predominantly affected by waves associated with the NE trade winds as well as hurricanes. These alter the beach's morphology and allow it to build out into the shallow environments offshore. The third and final beach examined in this study is Sandy Point Beach. Located on the southwestern side of the island, this highly-exposed beach is affected by both the trade winds during the summer months and northwesterly winds and longshore currents that flow down the western side of the island during the winter. The research presented here shows 1) the influence of beach location on geomorphology; 2) yearly "normal" variation in beach morphology; and 3) the effect of major hurricane events, specifically Hurricanes Frances (2004) and Joaquin (2015), on the beach systems.

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Michael Spencer, '16  
*English & Creative Writing*

Kalamazoo, MI  
*Michelle Mouton*

## **Another Man's Ear: Reimagining Carver's Soundscape in Robert Altman's *Short Cuts***

Film adaptations should be judged on the basis of how well they uphold the "original" piece. Robert Altman's film *Short Cuts*, an adaptation of several of Raymond Carver's texts, is no exception. Numerous critics have debated whether the film is truly worthy of Carver's legacy. The film's soundscape is among the elements contested. Critics concerned with fidelity are quick to assert Altman's sound deviations as failures, claiming the film is not recognizable as an echo of Carver's texts, while critics more concerned with the film's effectiveness than its fidelity to Carver's texts argue that changes are necessary when shifting media. Avoiding value judgements of the film in the context of Carver's texts, this presentation explores how sound in Altman and Carver differ and how we, as readers and listeners, experience both. Despite the fact that the film's soundscape is different from Carver's, Altman's transmutation of sound continues to illustrate a central theme in Carver's texts: the characters' entrapments and futile attempts to escape their lives.

**Sydney Strunk, '17**  
*Chemistry*

**Ottumwa, IA**  
*Jai Shanata*

## **Systematic Characterization of Cholesterol in Planar Lipid Bilayers by Single-Molecule Studies**

Cholesterol, a lipid biosynthesized within cells, is known to have a profound effect on cell membranes. An essential structural component, cholesterol not only increases bilayer stiffness and thickness, but plays a key role in facilitating membrane organization. There is growing evidence that lipids and proteins self-organize in order to bring about subcompartmentalization as a means of organizing the bioactivity of cell membranes. By laterally segregating membrane constituents, cholesterol is responsible for the creation of two co-existing phases: a thicker, liquid-ordered ( $L_o$ ) phase, in which cholesterol resides, and a thinner, liquid-disordered ( $L_d$ ) phase. The areas in the membrane containing higher concentrations of cholesterol and sphingolipids are known as lipid rafts, or microdomains.

In this research, different mole fractions of cholesterol in planar lipid bilayers were studied in order to discover the point at which membrane heterogeneity becomes present as a result of the formation of lipid rafts and to quantify changes in a functional protein in these varying lipid environments. The experiments applied electrophysiology to determine the impact of cholesterol on lipid bilayer physical properties through the incorporation of gramicidin A (gA), in which gA lifetimes were used as a readout. It is expected that two distinct gA lifetimes will be observed if lipid rafts are present in the model membranes and affect gA channels differently based on where the channels are localized. One gA lifetime duration would be representative of channels in cholesterol-enriched areas (lipid rafts), while the other lifetime duration would be in areas of low cholesterol concentration. The findings of this research have the potential to provide insight into the specific effects of cholesterol on protein activity and membrane organization that can be used to enhance the beneficial effects of prescription drugs.

**Julia Thome, '18**  
**Bryan Hernandez, '18**  
*Biology*

**Crystal Lake, IL**  
**North Hollywood, CA**  
*Marty Condon*

## Discovering Patterns of Diversity

The tritrophic community of the Neotropical fly *Blepharoneura*, its lethal parasitic wasp, and its cucurbit host plant shows surprisingly high levels of niche overlap and diversity. This diversity is made visible through work in the field and the lab, providing this study with species information on all three members of the community. Over thirty species of *Blepharoneura* have been identified, each with specific interactions with the other members of the tritrophic community. The focus of this poster presentation is on specimens that came from four different trips to the same site in Peru, each at different times of the year, between September 2006 and December 2007. The data taken from the sights have been sequenced and run through phylogenetic tree building programs that allow us to see this intricate web of speciation occurring. Over 200 samples were sequenced and analyzed over the summer. Analysis of these data resulted in possibly different patterns of relative species abundance for each collection date. Further analysis is needed to show statistical significance of these results; however, the data indicate that further studies at these sites in Peru could lead to more significant results. The DNA work that accompanied these specimens shows results that have been seen in the past. They confirm the levels of biodiversity that we have seen in years past. While they do accomplish this, they also show signs of different levels of diversity from year to year.

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**Bryanna Thompson, '16**  
*Art History*

**Carroll, IA**  
*Christina Penn-Goetsch*

## Robert Fludd's *The Mirror of the Whole of Nature and the Image of Art*

Robert Fludd was a seventeenth-century physician and philosopher who wrote an illustrated manifesto that addressed his philosophical theories of the universe, entitled *The Technical, Physical and Metaphysical History of the Microcosm and Macrocosm* of 1617-1626. Included in the text is a myriad of intricately-detailed engravings, including the engraving entitled *The Mirror of the Whole of Nature and the Image of Art*. This image directly follows the title page and summarizes his cosmological vision. Whereas several scholars have discussed Fludd's writings in depth, none have discussed the engravings beyond briefly mentioning them in biographies or reducing them to mere translations of the included Latin text. Art, science, and religion combine to make up his singular vision in these illustrations. My goal is to examine his central print and demonstrate how *The Mirror* reflects more than a scientific theory. Instead, it also represents a spiritual ideology.

*The Mirror* depicts the whole universe as Fludd conceived of it. Nevertheless, the work portrays not only a map of the universe, but also a map to the inner soul, as Fludd believed that the soul and the universe were intrinsically connected. First, the paper will briefly describe the book for which the image was created. A description of the image that references Fludd's conception of the macrocosm and microcosm will follow. This foundation will allow for an examination of his theories involving the divine spirit, the sun, and the creation of the universe. Finally, this paper will analyze the three realms of his universe: the empyrean, ethereal, and elemental in order to show that *The Mirror* can truly be seen as a depiction of not only the universe, but also the soul.

**Kristal Viera, '16**

*Art History*

**Springfield, MA**

*Christina Penn-Goetsch*

## ***La Plena: Rafael Tufiño and the Cultural Revival of Puerto Rico***

The Mural *La Plena* by Rafael Tufiño is an extraordinary artistic work that truly exemplifies Puerto Rican culture. *La Plena* documents a historical musical form of Puerto Rico; it also documents the history of the island and brings awareness to Puerto Rican history and folk music. The painting and a related documentary were commissioned during a time when Puerto Rican culture was being assaulted. One of the goals for the work's creation was to bring back a musical form nearly lost due to racial prejudices that encouraged the suppression of Puerto Rican identity by the United States. Both the mural and the musical form brought cultural pride back to an island that had been nearly deprived of it. However, to truly understand the mural and its significance, one must first understand the history of Puerto Rico and the musical form "La Plena." This presentation draws upon my research in Puerto Rico, when I worked, with the support of a Cornell Fellows grant, at the Museo de Arte de Puerto Rico this past fall. This paper covers the history of Puerto Rico from 1898, when the United States took control of the island, until the revitalization movement of the 1950s. This history is very important to the mural's significance and meaning. The analysis of the mural will identify the different songs within the mural and compare those findings with that of the Museo de Arte de Puerto Rico. Furthermore, the research discusses why the twelve songs were chosen by the artist and how they represent Puerto Rican identity. Finally, the analysis shows that the painting is indeed a mural despite its ability to be moved. All three sections are crucial to fully understanding how the mural, *La Plena*, summarizes the revival of Puerto Rican culture in the mid-twentieth century.

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**Donna Warfield, '17**

*Theatre*

**Ogden, UT**

*Scott Olinger*

## **Managing the Fantastic**

Kabuki theatre is an art form that seems otherworldly to Western theatre goers. From the elaborate costumes and makeup to the way the actors speak, nothing about Kabuki falls into the realm of realism that Westerners are accustomed to seeing at the theater. Kabuki theatre is actor focused. It is not unheard of for leading actors to be served tea during the middle of a performance. Audience members call out the family name of their favorite performers. Crew are there to assist the actors and are not even recognized by name in the program. This is wildly different from the Western world, where theatre is largely about the audience and crews get much recognition for their work. In the Western world, the unseen organizer of all things theatrical is the stage manager. Invisible when their job is done correctly, stage managers call all the cues for the show and are the main source of communication among actors, designers, and the director.

This presentation is a speculative project about how a Western stage manager could manage an Eastern performance of Kabuki. Is it possible to stage manage successfully an art as intricate as Kabuki? More importantly, is it necessary? Does traditional stage management even make sense for Kabuki? Through research, this session argues that, though it is entirely possible to stage manage a Kabuki performance, the nature of Kabuki takes away the necessity for a traditional Western stage manager.

## Analysis of a Five-Million-Year-Old Coral Suggests Modern-Style El Niño Activity

Due to its elevated temperatures and atmospheric CO<sub>2</sub> concentrations, the Pliocene warm period (PWP) (5.3-2.6 million years ago) is a common analog for a future, warmer world. The El Niño-Southern Oscillation (ENSO) is an ocean and atmosphere phenomenon punctuated by El Niño and La Niña events, changes in the distribution of warm water across the Pacific Ocean that currently occur every 2-7 years. ENSO is the strongest control on global interannual climate variability, yet the nature of ENSO during the PWP is the subject of debate, with conflicting computer models and geologically-derived reconstructions of sea surface temperature suggesting it was characterized by (1) a persistent El Niño-like state (Wara et al., 2005 *Science* v.309, p.758), (2) a persistent La Niña-like state (Rickaby and Halloran, 2005, *Science* v.307, p.1948), or (3) sea surface temperature variability consistent with modern ENSO conditions (Watanabe et al., 2011, *Nature* v.471, p.209). The study by Watanabe et al. (2011), which involves analysis of fossil corals from the western Pacific, differs from the other two studies which are derived from deep sea sediments spanning the tropical Pacific. Until now, no similar analysis has been performed on fossil corals from the eastern Pacific where ENSO-related sea surface temperature anomalies are most pronounced.

This research conducted a study similar to that of Wara et al. (2011) using pristine fossil corals from the Dominican Republic previously dated using U-Pb techniques (5.5±0.1 Ma) (Denniston et al., 2008, *Geology*, v.36, p.151). Today, the Dominican Republic is isolated from the eastern Pacific by the Central American Isthmus, but prior to ~2.7 Ma, the isthmus had not yet formed and Pacific waters flowed into the Caribbean Sea, potentially carrying ENSO signals directly into the Caribbean. The coral record suggests anomalous cold (warm) sea surface temperature excursions indicative of El Niño (La Niña) events occurred at intervals consistent with modern ENSO behavior. These findings should be integrated into paleoceanographic models at 5.5 Ma in order to better understand their connection to ENSO.

## Divine Divas: Feminist Studies of Operatic Females

Opera's biggest stars are and always have been women. The headliners and the titles are most often female, like Renee Fleming and *Carmen*. *Carmen*, Bizet's classic work about a strong-willed Gypsy woman who refuses to bow to male control, is one of the most accessible standards of the operatic repertoire, which makes it an ideal starting place for a feminist analysis of opera. The titular woman is the ideal representation of a strong female character, which makes her delightful to study in a feminist context. However, the opera itself is not. This paper looks at the ways that Bizet's work is and is not positive and sympathetic toward women. This analysis is performed in the context of feminist literary criticism, as well as musical and operatic criticism with feminist influences. This discussion is particularly important due to the fact that feminist criticism came so late to the discipline of music, though the field has grown quickly. *Carmen* can be used as a touchstone for an analysis and extended to many female-lead classics of the opera repertoire.

**Emily Wenzel, '17**

*Music*

**Shaver Lake, CA**

*James Martin*

## **Kundry Is Not Evil: Feminist Investigations of Wagner's *Parsifal***

*Parsifal*, Wagner's final *musik-drama*, is an epic tale about the Knights of the Holy Grail and the salvation of man from his own corruption. The particular man, Amfortas, owes his corruption to the feminine wiles of Kundry, the only named female character who appears onstage in the entire four-and-a-half-hour-long work. However, Amfortas is not the only one who can trace all his woes back to a female; Klingsor, the villain, was unable to maintain his chastity through will alone, so he removed the offending organ himself. The Knights of the Grail are slowly being seduced away, one by one, by Klingsor's impossibly beautiful flower-maidens, and Parsifal was so sheltered by his grieving mother that he does not know how to function out in the world. Despite this handicap, Parsifal saves Amfortas and the entire Grail community, owing his success to his ability to resist Kundry's allegedly irresistible seduction. This work does not have a positive view toward women. The poster session explores ways to stage the opera that ameliorate or even erase this negative attitude, and instead celebrate Kundry's often-overlooked contributions to the redemption of the Grail Community. The poster presents 3-dimensional models of possible sets, as well as discussions of costumes and blocking developed over a CSRI session with Dr. James Martin, informed by feminist literary and musical criticism, all of which seek to present the female as something other than evil in this otherwise misogynistic work.

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**Laura Wetzel, '16**

*Physics*

**Stevens Point, WI**

*Derin Sherman*

## **Motion of a Ball on a Spinning Saddle**

Ion trapping is useful for mass spectrometry, atomic clocks, and quantum computing. This poster discusses the investigation and characterization of a mechanical analogue to the Paul-type RF-electric-quadrupole ion trap: a ball on a spinning saddle. Both systems require a frequency of oscillation greater than a certain critical frequency in order to act as a trap. The research demonstrates successful short-term ( $>10$  s) confinement of a ball to the spinning saddle, and presents theoretical trajectories for literature motion models, including and disregarding friction. These trajectories were compared to experimental trajectories and both models were found lacking to describe the experimental motion. This research also investigates the differences in motion for different ball types and finds them to have different critical frequencies of confinement.

**Kayne Whyte, '16**  
*International Relations/Russian*

**Albuquerque, NM**  
*Lynne Ikach*

## **Вечная Память (Eternal Memory): An Analysis of Survivor Stories from Leningrad and the Soviet Union during the Great Patriotic War**

The Great Patriotic War (WWII) was one of the deadliest conflicts in Soviet history. For Russians, casualties amounted to approximately 26 million, half of which were civilians. The war was such a traumatic point in history that it still remains in the minds of the Russians today. In the West, we learn about the Second World War, but the focus is on the western nations' participation, and the contributions of other countries, such as the Soviet Union, tend to be glossed over. The purpose of this research stems from this lack of awareness. Вечная Память, or "Everlasting Memory," is an analysis of survivor stories from the Great Patriotic War with a focus on those who survived the Siege of Leningrad. The Siege of Leningrad was one of the pivotal moments of the war for the Soviet Union. The siege lasted 872 days, beginning September 8, 1941 and finally ending on January 27, 1944. It resulted in over four million casualties, with approximately a million of them being civilians. During the war, Leningrad faced severe food shortages, constant air raids and bombings, and deadly conditions in the winter. My research, an analysis of survivor stories from Leningrad and the Soviet Union during the Great Patriotic War, brings light to this event and tells of the siege through the eyes of those who had experienced it. The research explores how the survivors tell their stories and examines a number of recurring themes in the texts. Through translating and reading these stories, the hardships Soviet civilians experienced during the war should be remembered and shared.

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**Alexandra Young, '16**  
*Environmental Studies*

**Des Moines, IA**  
*Tammy Mildenstein*

## **An Analysis of Population Monitoring Methods: Creating a Standardized Counting Method for Southeast Asian Fruit Bats**

Fruit bats play a large role in the forest ecosystems they inhabit as major pollinators and seed-dispersal agents (Hahn et al. 2014). Unfortunately, these large bat populations are under major pressures through hunting and habitat loss (Stone 2007). Fruit bat populations in Myanmar have not been extensively studied or highly monitored in the past, although efforts are increasing with the creation of the Southeast Asian Bat Conservation Research Unit (SEABCRU). Consistent monitoring of these populations is essential to determine trends in the population sizes of these species and for researchers to have an idea of the impacts of these pressures of the current conservation methods (IUCN 2013). This study will assess the error present among three different methods of counting, binoculars, scope, and digital camera, in order to identify the most precise method. This research works to help create a standard method for counting these fruit bat populations, creating more consistent and reliable monitoring and population data.

**Anne Zegers, '16**  
*Geology*

**Machias, ME**  
*Emily Walsh*

## **Corrected Trace Element Data from UHP Garnets of the Tso Morari Complex, Ladakh Province, NW India: Evidence for Diffusion-Limited Uptake**

This project compares trends in the abundance of trace elements from the lanthanide series of rare earth elements (REE) from five garnets from the ultrahigh-pressure metamorphic Tso Morari Complex (TMC), Ladakh Province, NW India. Raw trace element abundance data were obtained by McElroy in 2013, using laser ablated-inductively coupled plasma mass spectrometry, and plotted in counts per second against length of laser ablation. These data were corrected using the known abundance of the isotope <sup>29</sup>silicon in garnet as an internal standard, following the procedure of Lin (2006). Changing trends of trace element abundance indicate changes in the rate at which trace elements are transported between garnet grains, commonly influenced by changes in metamorphic conditions. By correlating the sections of the element abundance profiles from the five garnets that represent periods of simultaneous growth, this study observed trends in the shape of the profiles that indicate changes in the rate at which trace elements were incorporated into the growing garnets as the trace elements diffuse through the parent rock. In the TMC garnets, the light REE form bell-shaped profiles, associated with rapid diffusion of trace elements in an unchanging assemblage of matrix minerals, or oscillating profiles, associated with rapid diffusion during the breakdown of matrix minerals (Moore et al., 2013). M-shaped profiles in the medium and heavy REE is interpreted to mean that the limiting factor in the rate of trace element uptake by the garnets was the rate at which the trace elements were transported through the intergranular medium (Moore et al., 2013).

# 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 a faculty steering committee in conjunction with the Center for Teaching & Learning, occurs in April each year.

The Symposium features three modes of presentation. One is an oral presentation of 20 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.