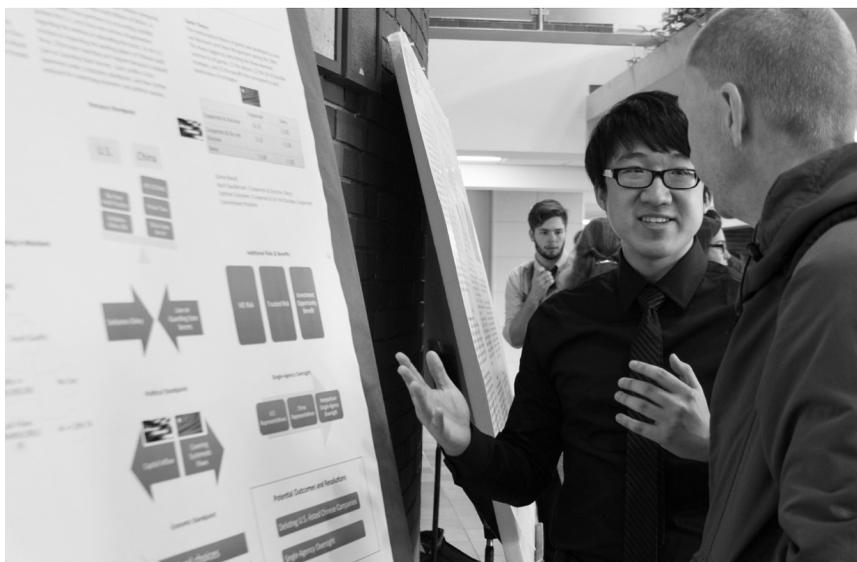


# Student Research Symposium

Friday, May 6, 2016





# LUTHER COLLEGE

To the Luther Community:

Welcome to the annual Student Research Symposium at Luther College! This day is one of the highlights of our academic year, featuring the outstanding work of many of our talented, curious, and accomplished students, under the skillful and inspired guidance of our faculty.

In this program you will find the full schedule of events. At Luther, we talk a lot about the value of “learning in community.” And we mean it. We set aside classes for this day, so that the entire community—students, faculty, staff, and guests—can learn from and with our students, as they share the results of their discovery, reflection, and creation from this academic year.

The day begins with a plenary session and keynote address to kick off the celebration. For the opening session’s “keynote,” we have chosen two outstanding seniors to reflect on their research experiences, in a kind of dialogue on their broader journey in the liberal arts. The projects undertaken by these two students, Jenna Johnson and Laura Proescholdt, represent the kind of complex learning—rooted in both disciplinary and inter-disciplinary approaches—that Luther fosters to help our students and our society identify, understand, and address significant issues in our world. As part of this kick-off, we will congratulate all of the scholars who will present today, framed by celebratory music from our trumpet studio and first-year choirs.

Following the opening session, the day will unfold with concurrent sessions of talks, posters, exhibitions, and performances by many of the top students at Luther in majors across the college. Session topics and descriptions of each presentation (abstracts) are included in this program. In addition to these sessions, please also see the separate brochure listing sessions that illustrate the kind of lively and intriguing research being done in our common first-year spring course, Paideia 112: Enduring Questions.

The day will conclude with two evening performances: a full production of Franz Lehár’s operetta *The Merry Widow*, performed by students in our music program’s opera workshop; and a theatre performance, *The Illusion*, by Pierre Corneille and Tony Kushner, presented by students in our program in the visual and performing arts.

We are delighted that you have joined us today to see and to celebrate the fruits of our students’ talents and labors this year. We hope the day inspires you.

Sincerely,



Kevin Kraus  
Dean of the College

## STUDENT RESEARCH SYMPOSIUM DAY-AT-A-GLANCE

**SESSION I: 9:00–9:45 A.M.**

**OPENING EVENT: CELEBRATION AND KEYNOTE ADDRESS**

*Center for Faith and Life Main Hall*

- Research Reflections: Jenna Johnson '16, Laura Proescholdt '16
- Recognition of Symposium Participants: Kevin Kraus, dean of the college
- Luther College Trumpets (John Cord, conductor)
- Aurora and Norsemen (Jennaya Robison and Andrew Last, conductors)

**SESSION II: 10:00 A.M.–11:00 A.M.**

<i>Dahl Centennial Union, Mott-Borlaug</i>	<i>Dahl Centennial Union, Hammarskjold</i>	<i>Center for Faith and Life Recital Hall</i>	<i>Valders 262</i>	<i>Olin 101</i>	<i>Olin 102</i>	<i>Preus Library, Howde Lounge</i>	<i>Dahl Centennial Union, Gallery</i>	<i>Valders classrooms</i>
<b>Kidneys, Proteins, and Antibodies</b>	<b>Local Issues, Global Implications</b>	<b>From Idea to Performance</b>	<b>Stress and Stigmatization</b>	<b>On Being Human</b>	<b>App-raising Music</b>	<b>Revenue and Resources</b>	<b>Collage in a Commodified World (Gallery Talk)</b>	<b>Paideia 112 Research (see separate brochure)</b>

**SESSION III: 11:15–12:15 P.M.**

<i>Dahl Centennial Union, Mott-Borlaug</i>	<i>Dahl Centennial Union, Hammarskjold</i>	<i>Center for Faith and Life Recital Hall</i>	<i>Valders 262</i>	<i>Olin 101</i>	<i>Olin 102</i>	<i>Preus Library, Howde Lounge</i>	<i>Jenson-Noble Recital Hall</i>	<i>Valders classrooms</i>
<b>Moving through Space</b>	<b>Reforming Religion</b>	<b>What Are We Communicating?</b>	<b>The Body of Human Knowledge</b>	<b>A Blast from English Past</b>	<b>Super [Math] Models</b>	<b>How the World Works</b>	<b>On the Way to Carnegie Hall</b>	<b>Paideia 112 Research (see separate brochure)</b>

**LUNCH BREAK: 12:15–1:00 P.M.**

*Community Dessert Gathering: Complimentary desserts and ice cream novelties (Benttdahl Commons, Central Campus)*

**SPECIAL EVENT: 9:00 A.M.–9:00 P.M.**

*Sound Garden: Benttdahl Commons, Central Campus*

**SESSION IV: 1:00–2:00 P.M.**

Dahl Centennial Union, Mott-Borlaug	Dahl Centennial Union, Hammarskjöld	Center for Faith and Life Recital Hall	Valders 262	Olim 101	Olim 102	Preus Library, Hovde Lounge	Jenson-Noble Recital Hall	Valders classrooms
Polymers, Plastics, and DNA	In Touch with Empathy	Behind the Scenes	Impacting the Earth	Perspectives on Art	Search Me ...	Spanish: Pros and Cons	A Different Song and Dance	Paideia 112 Research (see separate brochure)

**SESSION V: 2:15–3:15 P.M.**

Dahl Centennial Union, Mott-Borlaug	Dahl Centennial Union, Hammarskjöld	Center for Faith and Life Recital Hall	Valders 262	Olim 102	Valders 375	Valders classrooms
Unintended Environmental Consequences	Faithful Attractions	Normal Life	Luther College: Dollars and Sense	Where and When?	All About Galileo	Paideia 112 Research (see separate brochure)

**SESSION VI: 3:30–5:00 P.M.**

Poster Session in Sampson Hoffland Laboratories Carlson Atrium/Valders Hall of Science Concourse (with refreshments and chamber music)

**EVENING EVENTS: 7:30 P.M.**

7:30 p.m. Opera Performance: *The Merry Widow* by Franz Lehár (Center for Faith and Life Main Hall)

7:30 p.m. Theatre Performance: *The Illusion* by Pierre Corneille and Tony Kushner (Center for the Arts Jewell Theatre)

## SYMPOSIUM SCHEDULE

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9:00–9:45 A.M.  
SESSION I

*Center for Faith and Life Main Hall*  
**Opening Convocation Celebration and  
Keynote Address**

- Research Reflections: Jenna Johnson '16,  
Laura Proescholdt '16
- Recognition of Symposium Participants:  
Kevin Kraus, dean of the college
- Luther College Trumpets (John Cord,  
conductor)
- Aurora and Norsemen (Jennaya Robison and  
Andrew Last, conductors)

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10:00–11:00 A.M.  
SESSION II

*Dahl Centennial Union, Mott-Borlaug*  
**Kidneys, Proteins, and Antibodies**  
*Faculty moderator: Dawn Reding*

**Reed Johnson '16**  
Passion in Science: A Case Study on the  
Process of Antibody Formation

**Matthew Borchart '16**  
Absence of PKC-alpha Alters the Renal  
Immune Response in Angiotensin II-  
dependent Hypertension

**Jenna Johnson '16**  
Using Worms to Understand Iron in Disease

*Dahl Centennial Union, Hammarskjold*  
**Local Issues, Global Implications**  
*Faculty moderator: Lori Stanley*

**Andrea Woodberry '16**  
Learning Collaboration: Resettling Hmong  
Refugees in Decorah, Iowa

**Emily Dufford '16**  
Redefining Affluence: What We Can Learn  
from Off-the-Grid Families in Decorah, Iowa,  
about a Sustainable Future

**Sarah Sturm '17**  
Community Political Activism Related to  
Frac Sand Mining in Winneshiek County

*Center for Faith and Life Recital Hall*  
**From Idea to Performance**  
*Faculty moderator: Megan Strom*

**Sarah Rickertsen '16**  
World-Building, Character Development,  
and Structure as Novel-Drafting Strategies

**Pablo Gomez Estevez '17**  
“Lulito”: A Celebration of Childhood  
through Text Painting

**Taylor Berg '16**  
*Strange Fruit*

*Valders 262*  
**Stress and Stigmatization**  
*Faculty moderator: Angela Kueny*

**Megan Nading '16**  
**Sandra Cardenas '16, Pharez Monney '17**  
Stress and Social Support

**Sandra Cardenas '16**  
**Pharez Monney '17, Megan Nading '16**  
The Fluctuation of Food Choices and  
Exercise Habits of Luther College Students  
throughout the School Year

**Karin Hecht '16**  
Understanding the Partially Deceased: A  
Unique Portrayal of Mental Illness in BBC's  
*In The Flesh*

*Olin 101*  
**On Being Human**  
*Faculty moderator: Sören Steding*

**Kristen Carlson '18**  
Polyphemus, the Creature, and Gregor  
Samsa: Three Monsters in Search of  
Humanity

**Kathryn Yarwood '17**  
Supernatural Threats to Humanity Examined  
Through Film

**Erik Hahn '16**  
Exploring and Uncovering Heidegger: The  
Ontic/Ontological Distinction

*Olin 102*  
**App-raising Music**  
(Computer Science Capstone Projects)  
*Faculty moderator: Brad Miller*

**Austin Nash '16**  
**Jakob Jorgenson '16, Ehren Kluge '16,**  
**Evan Woodard '16**  
Project SAEJE: A Mobile Application for  
Musical Composition  
**Ellen Widorski '16**  
**Michael Espey '16, Robbie Nesmith '17**  
Party Animal: A Social Music Experience

*Preus Library, Hovde Lounge*  
**Revenue and Resources**  
*Faculty moderator: Ryan Torkelson*

**Aaron Fargo '16**  
How the United States Should Tax Its  
Income  
**Uyen Truong '16**  
To Prevent Corporate Inversion: Tax Reform  
or Restrictive Measures  
**William Hatungimana '16**  
Mining and Development in African  
Countries: A Comparative Analysis

*Dahl Centennial Union, Union Gallery*  
**Collage in a Commodified World**  
**(Gallery Talk)**  
*Faculty moderator: Chandra Jennings*

**Kristin Anderson '16**  
Cut/Paste: Collage in a Commodified World

*Valders classrooms*  
**Paideia 112 Research**  
**(see separate brochure)**

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11:15 A.M.–12:15 P.M.  
SESSION III

*Dahl Centennial Union, Mott-Borlaug*  
**Moving Through Space**  
*Faculty moderator: Claude Mertzenich*

**Daniel Herman '16**  
Modeling Apparent Stellar Brightening  
Events as Gravitational Microlensing  
**Jesse Hitz Graff '16**  
MEMS, Myself, and I: Understanding the  
Wear Mechanism of Silicon Oxide and  
Aluminum Oxide on the Nanoscale  
**Jayse Weaver '16**  
Where's the Wear? An Analysis of Nanoscale  
Wear between Silicon and Aluminum Oxide

*Dahl Centennial Union, Hammar skjold*  
**Reforming Religion**  
*Faculty moderator: Dan Davis*

**Ethan Taylor '16**  
Luther and Libation: Alcohol, Reformation,  
and Society in Early Modern Germany  
**Keziah Grindeland '16**  
The Myth of Religious Violence: The  
Dichotomy between Religious and Secular  
Violence as a Reality or a Western Construct  
**Makayla Marinack '16**  
Jephthah's Daughter: Ancient Stories, New  
Voices

*Center for Faith and Life Recital Hall*  
**What Are We Communicating?**  
**(Communication Studies Senior Projects)**  
*Faculty moderator: Kim Powell*

**Brady Brinkmeyer '16**  
*Star Wars*: A Cautionary Tale on the Overuse  
of Technology in our World

**Emily Gehlsen '16**  
Athlete Burnout in Young Females: Parental  
and Coach Involvement, Communication  
Patterns, and Body Distortion

**Josh Harper '16**  
We Were All Cheated: An Ideological  
Critique of the First Postmodern Video Game

**Ashley Kappers '16**  
Only Children and Communication: Conflict  
in Adult Interpersonal Relationships

**Eleanore Sell '16**  
Here Was a Woman: An Ideological  
Criticism of Gender Dynamics in HBO's  
*Deadwood*

*Valders 262*  
**The Body of Human Knowledge**  
*Faculty moderator: La Donna McGohan*

**Anne Willey '16**  
Against the Great Destroyer: Prince Edward  
Island Medical Practice, L.M. Montgomery,  
and Dr. Gilbert Blythe

**Robert Manges '16**  
Epistemological and Pedagogical Value of  
Human Dissection

**Sandra Cardenas '16**  
Cultural Competency among Nursing  
Students

Olin 101

**A Blast from English Past**

Faculty moderator: Jaci Wilkinson

**Jordan Blank '16**

A Verse Translation of Geoffrey Chaucer's  
General Prologue

**Bryn Hedlund '16**

Persuasiveness through Pronouns in *Macbeth*:  
The Diachronic Evolution of English in  
Literature

**Cassidy Woods '18**

"Untimely Ripped"

Olin 102

**Super [Math] Models**

Faculty moderator: Brad Miller

**Stephen Becklin '16**

**Robbie Nesmith '17, Ellen Widerski '16**  
Connecting the 1-D Sandpile Model with  
the Generalized Catalan Numbers

**Erin Ellefsen '17**

**John Doorenbos '16**

Herd Immunity in Discrete Networks

**Ales Varabyou '17**

Adaptive Computer Vision

Preus Library, Hovde Lounge

**How the World Works**

Faculty moderator: Carly Hayden Foster

**Douglas Tuers**

The Role of Language in Shaping an  
Intellectual History of the Atlantic Slave Trade

**Dmitry Vorona '17**

Russian Cultural Exceptionalism in Context  
of Foreign Policy

**Katherine Vorderbruggen '16**

Constructing Independence: International  
Principles and the Status of Kosovo

Jenson-Noble Recital Hall

**On the Way to Carnegie Hall**

Faculty moderator: Laurie Iudin-Nelson

**Trever Schwichtenberg '17**

**Matt Dosland '19, Amanda Eby '17**

Beethoven's Piano Trio in C minor, Op. 1  
No. 3 Mvmt I, III, IV

**Namuun Tsend-Ayush '17**

Adagio from J.S. Bach's Sonata for Solo  
Violin No. 1 in G minor

Valders classrooms

**Paideia 112 Research**

(see separate brochure)

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1:00–2:00 P.M.

**SESSION IV**

Dahl Centennial Union, Mott-Borlaug  
**Polymers, Plastics, and DNA**

Faculty moderator: Brad Chamberlain

**Claire Seitzinger '16**

Controlled Polymerization of D,L-lactide  
with Titanium(IV) Tartrates

**Jenna Johnson '16**

Investigating Protein and DNA Interactions:  
The BRG1 Bromodomain and Its Association  
with Nucleosomes

**Emily Mueller '16**

Application of Novel Sulfonamide Ligands in  
Selective Polymerization of Lactide

Dahl Centennial Union, Hammar skjold

**In Touch with Empathy**

Faculty moderator: Brian Caton

**Hailey Johnson '16**

**Shane O'Leary '16, Andy Todd '16, Emilee  
Velander '16**

Teaching Empathy, Perspective Taking, and  
Inquiry

Center for Faith and Life Recital Hall

**Behind the Scenes**

Faculty moderator: Amy Weldon

**Emma Cassabaum '16**

**Cierra Buckner '18, Emily Garst '18,  
Maggie Sulentic '16**

*Predisposition*: A Play about Memory

Valders 262

**Impacting the Earth**

Faculty moderator: Mike Engelhardt

**Jane Wilson '16**

Plio-Pleistocene Climate Change: Insights  
from a New Sea Surface Temperature Record  
from the Southern Pacific Ocean

**Lindsay Getschel '16**

Addressing the Climate Paradox: Strategies  
for Successful International Climate  
Negotiations

Olin 101

**Perspectives on Art**

Faculty moderator: Kate Elliott

**Taylor Kinley '16**

Linear Perspective: Masaccio's Legacy and  
Late 19th-Century Adaptations

**Laura Turco '16**

The Braccacci Chapel: The Legend, The Inspiration, and The Controversy

**Avery Jamison '17**

Connecting the Visual and Performative: Merce Cunningham and Robert Rauschenberg

**Jenna Courtney '16**

An Iranian Feminist Forever Abroad, and Her Navigation in the Purgatory between Western and Eastern Thought

*Olin 102*

**Search Me ...**

(Computer Science Capstone Projects)

*Faculty moderator: Brad Miller*

**Ales Varabyou '17**

**Sergei Hanka '17, Miriam Harries '16,**

**Kirby Olson '17, Jessica Tan '16**

Lost and Found Application

**Aren St. Louis '16**

**Hunter Lynch '16, Juan Navarro '16,**

**Dichha Rai '16**

Norse Trip

*Preus Library, Hovde Lounge*

**Spanish: Pros and Cons**

*Faculty moderator: Laurie Zaring*

**Bryn Hedlund '16**

Focusing on Topic: The Use of the Left Periphery in Spanish

**Ryan Goos '16**

Language Endangerment and Revitalization: The Case of Quechua

*Jenson-Noble Recital Hall*

**A Different Song and Dance**

*Faculty moderator: Brooke Joyce*

**Logan Larson '16 (composer)**

**Tad Guy '18, Sam Haefner '18, Sylvia**

**Kaare '17, Aidan Schmitt '17**

The Electronic Percussion Carnival

**Peter Swanson '16**

*Lasciate Ogne Speranza Voi Ch'intrate: An Original Composition Utilizing Screaming Vocals in Classical Music*

**Jeremy Maas '16**

**Namuun Tsend-Ayush '17**

"A Dog Has Died" for Violin Solo

*Valders classrooms*

**Paideia 112 Research**

(see separate brochure)

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2:15–3:15 P.M.

**SESSION V**

*Dahl Centennial Union, Mott-Borlaug*

**Unintended Environmental Consequences**

*Faculty moderator: Molly McNicoll*

**Marcella Meza '18**

**Nathaniel Hemming '18, Kieran**

**Okerstrom '17**

Impacts of a Single-turbine Wind Facility on Bat Activity and Fatality in Northeastern Iowa

**Zoe Bachman '16**

Emodin in *Rhamnus cathartica* (European Buckthorn) as a Potential Novel Weapon: Effects on Native *Ageratina altissima* (White Snakeroot)

**Dominique Itanze '16**

Determining the Binding of Environment Pollutants to Host Molecules Using Fluorescence Spectroscopy

*Dahl Centennial Union, Hammarskjold*

**Faithful Attractions**

*Faculty moderator: Todd Green*

**Keziah Grindeland '16**

Malala Yousafzai: Western Media's Interpretation of Muslim Voices

**Christopher Lovagnini '16**

Loving Thy Neighbor: Why Do Christian Communities in France and America Interact and Engage with Muslim Communities in Different Ways?

**Emily Holm '16**

Children and Change: Engaging Christian, Jewish, and Muslim Youth in Interfaith Dialogue

*Center for Faith and Life Recital Hall*

**Normal Life**

*Faculty moderator: Holly Moore*

**Ashley Meyers '16**

"A Transition is Like Having a Death without the Casseroles": A Case Study of Gender Transition, Marriage, and Identity

**Marfiano Manuel '16**

Learning from a Women and Gender Studies Internship

**Anna Jeide '16**

The True "Threshold of Revelation" in *Angels in America*

Valders 262

### **Luther College: Dollars and Sense**

*Faculty moderator: Tony Mutsune*

**Patrick Larson '17**

The Qualitative and Quantitative Dimensions that Shape the College Process

**Kylie Romeo '16**

Evaluating the Sustainability of Luther College's Tuition Discount Rate

**Madeline Geier '17**

Standing in Solidarity: An Analysis of How American Colleges Can Most Effectively Confront Islamophobia

Olin 102

### **Where and When?**

(Computer Science Capstone Projects)

*Faculty moderator: Brad Miller*

**Grant Barnes '16**

**John Doorenbos '16, Michael Moore '16, Blaise Schaeffer '16**

NorseCourse: A Luther Student Schedule Planner

**Dorjee Dhondup '16**

**Ryan Bennett '16, Zach Stekel '17**  
RoomReserve

Valders 275

### **All About Galileo**

(Poster-based session)

*Faculty moderator: Ruth Kath*

**Shayla DeJong '16**

Galileo and the Catholic Church: Man of Science or Devious Heretic?

**Jonathon Kaupa '17**

Galileo's Improvement on the Telescope

**Timothy Walch '17**

The Changing of the Military: Galileo Galilei's Contribution to Changing Military Tactics

**This session also will include posters and discussion on aspects of Galileo's life and work from members of the Fall 2015 class, German 450: Masterpieces of German Literature, who are abroad in Muenster this spring.**

Valders classrooms

### **Paideia 112 Research**

(see separate brochure)

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## SESSION VI

*Sampson Hoffland Laboratories, Carlson*

*Atrium/Valders Hall of Science Concourse*

### **Poster Session**

*Faculty moderator: Kirk Larsen*

**Stephen Becklin '16**

Comparison of Two Methods to Solve the 2-D Heat Transfer Model

**Reed Bowden '16**

How to Break the Farwell Bridge: A Structural Analysis

**Sandra Cardenas '16**

Supplement Use within Old Order Amish Families with Hemophilia

**Katelyn Evenson '16**

The Influence of Neophobia, Human Familiarity and Human Attentional State on Eating Behavior in Blue Jays

**Benjamin Henson '16**

The Inclusion of Injury-Prevention Strategies in Beginning Violin Method Books

**Kristin Housholder '16**

**Katelyn Janssen '16**

Slowing BMI Growth Trajectories in Primary-Aged School Children: The Northeast Iowa Food and Fitness Initiative

**Blake Letney '16**

Interaction between PI3K Pathway and Iron Homeostasis

**Allura Lothary '16**

Does Developmental Generativity Predict Substance Use in Middle Aged Adults?

**Laura Post '16**

**Robert Manges '16**

The Effect of a calR Mutation on Gene Expression in *Vibrio parahaemolyticus* under Varying Calcium and Iron Conditions

**Isaac Prichett '16**

Synthesis of a Compound to Control the Assembly of Biodegradable Plastics for Better Heat Resistance

**Rachel Rem '16**

Persistence and Gazing at Humans during an Unsolvable Task depends on the Age, Sex, and Experience of Pet Dogs

**Tricia Serres '16**

Effects of Increasing Core Body Temperature on Running Economy

**Emma Stivers '17**

A Comparison of Butterflies on Remnant and Planted Prairies in Northeast Iowa: Species Richness and Diversity

**Yifeng Zhang '17**

*Vibrio parahaemolyticus* Swarmer Cell Differentiation: The Polar Flagellum as the Sensory Organelle

**Additional poster displays presented by students from the following classes:**

Biology 112: Insects, Humans and the Environment

Biology 232: Microscopy Laboratory

Biology 250: Restoration and Conservation Biology

Biology 354: Evolutionary Biology

Physics 182: Classical Physics II

Physics 114: Sound and Musical Acoustics

Psychology 353: Social Psychology

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**7:30 P.M.**

**Opera Performance: *The Merry Widow* by Franz Lehár**

*Center for Faith and Life Main Hall*

Students from the music department perform Franz Lehár's charming operetta *The Merry Widow*. Lehár's was gifted at memorable melodies and brilliant orchestral writing, and *The Merry Widow* remains one of the most frequently performed operettas today. The show tells the story of the recently widowed and now very wealthy Hannah, and the plot that unfolds to find her a suitable new husband in the fictional 20th-century country of Pontevedro. Hannah struggles to find a suitor more interested in her than in her new fortune, and when her ex-lover Danilo appears, complications arise.

Directed by Karen Kanakis, associate professor of music (stage director), and Jacob Lassetter, assistant professor of music (musical preparation). The performances will be sung in English and accompanied by the Luther College Chamber Orchestra, conducted by Daniel Baldwin, professor of music.

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**7:30 P.M.**

**Theatre Performance: *The Illusion* by Pierre Corneille and Tony Kushner**

*Center for the Arts Jewel Theatre*

In the dead of night a father creeps into a dark cave in the hopes that the magician said to live there can reunite him with his lost son. The shadowy conjurer, it turns out, can show the father the life of his son as it has played out. *The Illusion* performs a story of wild passion, betrayal, and the other vagaries of love. Tony Kushner's lively adaptation of Corneille's comedy explores the power of those things that seem to have no substance at all and yet can effect profound change in us.

Luther College's production of *The Illusion* is the culmination of an experiment in rehearsal process. Each actor crafted a unique mask drawn from physical explorations prompted by the director and information from the script. The masks helped them to solidify and build on their initial physical impulses. From these masks, and later from red-nose clown work, actors were prompted to turn these impulses into characters with histories and futures that they could enact in improvisations. Even though they've removed their red noses for the performance, the voices, gestures and physicalizations in this performance all come from the body's creative play channeled through clown work.

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**9:00 A.M. – 9:00 P.M.**

**Sound Garden**

*Bentdahl Commons*

This semester, Luther's composition studio, directed by Composer-in-Residence Brooke Joyce, has been working on collaborative sound sculptures with local middle and high school students through ArtHaus's Young Apprentice Program. Funded by a grant from the Cargill Foundation, these sound sculptures comprise sounds gathered by the composers from around the campus, and processed using the audio software Reaper. Come wander through.

## PARTICIPANTS AND ABSTRACTS

Arranged alphabetically by student last name, and for presentations involving more than one student, arranged by lead student's last name (alphabetically within presentation)

KRISTIN ANDERSON '16

### **Cut/Paste: Collage in a Commodified World**

Since the 1920s, the Dada tradition of assembling printed media has transformed remnants of the everyday into visual art. Artists such as Hannah Hoch, Barbara Kruger, and Robert Rauschenberg gave witness to an evolving mass-media culture, creating works that conflate images with reality. With the rise of the digital age, one might wonder if physical assemblage, cut-and-paste collage, is still relevant. Although digital technology has altered the aesthetic and delivery of advertising, an examination of contemporary visual culture reveals that overarching narratives favoring the objectification of the female body, the analogous sexualization of flesh and food, and the consumption of images as hyper-real have remained largely unchanged since the explosion of advertising in the mid-20th century. My studio practice uses painting and collage to deconstruct patterns of representation in women's magazines and to utilize images in constructing new spaces. In reducing images to their most basic visual properties—form, line, color, etc.—these surreal landscapes bring to light the absurdity of sensationalized mass media. This presentation will function as an artist's talk, with a focus on my art and the research that informs it.

*Faculty sponsor: Ben Moore*

ZOE BACHMAN '16

### **Emodin in *Rhamnus cathartica* (European Buckthorn) as a Potential Novel Weapon: Effects on Native *Ageratina altissima* (White Snakeroot)**

*Rhamnus cathartica* (European buckthorn) is an invasive woody species in the upper Midwest that creates high-density infestations, impacting native communities through multiple physical and chemical mechanisms. Previous research has shown that *R. cathartica* produces emodin, which influences soil chemistry, deters predation, inhibits amphibian growth, and indirectly affects plant germination and growth. This study tested the effect of emodin on germination and growth of the common native herbaceous species *Ageratina altissima* (white snakeroot). Seeds and seedlings of *A. altissima* were exposed to varying concentrations of emodin and evaluated

for germination, cotyledon development, true leaf development, photosynthetic area, and senescence. Emodin did not affect germination of *A. altissima* in lab conditions. However, emodin variably influenced emergence, senescence, and photosynthetic area of seedlings in early growth stages in a greenhouse setting. Results were complicated through the use of a solubilizing agent used to keep the emodin in solution, but trends emerged at high concentrations of emodin. Preliminary evidence shows that emodin may possess some traits as a novel weapon at the stage of seed establishment but not at the germination stage. Further studies are necessary to confirm the trends observed in this pilot study.

*Faculty sponsor: Molly McNicoll*

GRANT BARNES '16

### **JOHN DOORENBOS '16, MICHAEL MOORE '16, BLAISE SCHAEFFER '16, NorseCourse: A Luther Student Schedule Planner**

NorseCourse is an intuitive web application that allows Luther students a user-friendly avenue to plan their schedule. The single web application not only allows students to look up individual courses and their sections but also allows them to use our custom-made scheduling algorithm to easily view potential schedules for their desired courses and/or general education requirements. We had two main objectives for improving course scheduling. First, we wanted to give students a convenient means to search for courses by the criteria most important to them, such as general education requirements and professor. Second, we also wanted to allow students to automatically view possible schedules based on their needs. This project required not only teamwork among its members but also collaboration with the Luther College Software Development Team. We hope this webpage, hosted by Blaising Fast Cloud Services and built with modern technologies such as AngularJS, Material Design, Flask, Swagger, and MySQL, will be well suited to assist students as they plan their schedules. Our presentation will showcase this web app and describe the process we used to create it.

*Faculty sponsor: Brad Miller*

STEPHEN BECKLIN '16  
ROBBIE NESMITH '17,  
ELLEN WIDERSKI '16

### **Connecting the 1-D Sandpile Model with the Generalized Catalan Numbers**

The study of avalanches in the one-dimensional sandpile model is deeply connected with number theory. This dynamic model investigates avalanches formed through the repeated process of adding sand to random locations in the sandpile. Avalanches occur in this model when the slope of the sandpile becomes too large. Chhabra, Feigenbaum, Kadanoff, Kolan, and Procaccia showed that the total number of recurrent states in this dynamic model can be described by the Catalan numbers, an important numerical sequence that appears in many branches of mathematics. For example, the Catalan numbers count the number of ways to properly arrange  $n$  pairs of parentheses. We provide an alternate proof by constructing an explicit 1-1 correspondence between recurrent sandpile configurations and proper arrangements of pairs of parentheses. We extend this correspondence to show that the total number of stable states can be described by a generalized Catalan sequence.

*Faculty sponsor: Michael Johnson*

### **STEPHEN BECKLIN '16 Comparison of Two Methods to Solve the 2-D Heat Transfer Model**

In the field of partial differential equations, we often work with systems in which it is too difficult or impossible to find analytic, or exact, solutions. As a result, mathematicians have developed alternate methods to produce solutions that balance accuracy with efficiency. In this project, I worked with an instance of the 2-D heat transfer model and solved the system using two different, but related, methods: the Fourier series method and the finite analytic method. The former uses principles of Fourier approximation on an entire domain to solve the system up to a desired accuracy. The latter uses a similar process over a discretized domain, thus simplifying the problem and decreasing the need for computational resources. After solving the general system using these two methods, I compared the accuracy and efficiency for various systems.

*Faculty sponsor: Richard Bernatz*

TAYLOR BERG '16  
***Strange Fruit***

*Strange Fruit* is a solo dance inspired by the poem originally titled "Bitter Fruit" by the white American writer, teacher, and songwriter Abel Meeropol, in protest of the lynchings of African Americans in the 1930s. It is also important to note the historical context, as the song has been choreographed before, most famously by Pearl Primus in 1945. Also, core to this research is the study of past and present antiracism policies and practices that oppose racism and promote racial tolerance. From those strategies, I use movement as my research tool to evoke the tension between aggression and reconciliation. I consider that my identity as a young white woman acts as an unsettling embodiment in reference to the historical context that frames my research. In creating and performing this piece, I am aiming to portray through movement a current theme and to open conversation about the pernicious and socially pervasive qualities of racism and the political, economic, and/or social changes that are required to eliminate it. My performance will be four minutes in length and will be followed by a post-performance commentary.

*Faculty sponsor: Andrea Vazquez Aguirre*

### **JORDAN BLANK '16 A Verse Translation of Geoffrey Chaucer's General Prologue**

The issue of translation vexes those who read—or assign—literature written outside of their native language. While translations can provide a surface-level understanding of a text to foreign readers, cultural nuances and social contexts unique to the source culture are often lost in translation. In particular, figurative language and stylistic features do not translate well. How does a translator communicate these elements if there are no correlative expressions in the translated language? To what extent does a translation ever remain true to the original text? To explore these questions, I translated the General Prologue from Chaucer's *Canterbury Tales* from Middle English into Contemporary English. In preparation, I researched translation methods and medieval English culture, studied the grammar and syntax of Chaucerian Middle English, and read other Middle English texts. Working line by line, pilgrim by pilgrim, I composed 860 lines of verse. The result was an original Contemporary English translation of the General Prologue that retains Chaucer's rhyme scheme and meter. As part of my research process, I also studied how translated

texts and the *Canterbury Tales* in particular are taught in high school and college classrooms, and my translation uniquely reflects that context. My project provides contemporary readers with an analytical and interpretative analogue to the General Prologue and explores the beginnings of the English we still speak today.

*Faculty sponsor: Lindsey Row-Heyveld*

MATTHEW BORCHERT '16

### **Absence of PKC-alpha Alters the Renal Immune Response in Angiotensin II-Dependent Hypertension**

Hypertension is a leading cause of kidney failure. T-cell proliferation and accumulation stimulated by angiotensin II (Ang II), a hormone, plays a role in hypertension development and end-stage kidney damage. Unfortunately, the signaling mechanisms behind this immune response remain underexplored. One pathway to Ang II and T-cell response is mediated by PKC-alpha, an intracellular signaling protein. To determine the role of PKC-alpha in facilitating T-cell infiltration in the kidney during Ang II-dependent hypertension, PKC-alpha knock-out (KO) mice were treated with saline or Ang II and compared to PKC-alpha wildtype (WT) mice. Systolic blood pressure, water intake, and urine output were increased in Ang II-treated mice. Kidney damage and collagen deposition were elevated with Ang II treatment and appeared more extensive in KO mice. Ang II treatment increased spleen weight in WT mice, suggesting that the absence of PKC-alpha attenuates increased immune cell production. Histological examination of the renal cortex revealed that Ang II treatment increased helper T-cells in WT and KO mice and suggests that helper T-cell recruitment is higher in Ang II-treated WT compared to KO mice. Immune cell infiltration and cytokine production measurements suggest that PKC-alpha is important for Ang II-mediated cytokine release in renal tissues. Collectively, these data suggest that the absence of PKC-alpha decreases inflammatory response to Ang II-induced hypertension in the kidney.

*Faculty sponsor: Gwen Strand*

REED BOWDEN '16

### **How to Break the Farwell Bridge: A Structural Analysis**

Farwell Hall was built in a unique location on campus. It was built at the bottom of the western bluff, meaning the easiest way for students to

reach the main campus is via a bridge on the top floor. Many students use this steel bridge every day to get to class or to head back home. However, not many students will question the engineering of the bridge that allows for Farwell Hall to function. This structural analysis project will examine the forces that each member of the bridge experiences, from its own weight, the weight of students crossing, or even the weight of snow upon the roof. By examining these forces using equilibrium equations and engineering software, the structural integrity of the bridge can be determined. This analysis will give a better understanding of maximum stresses the bridge can withstand and how the bridge responds to unexpected or extreme loads applied the structure.

*Faculty sponsor: Erin Flater*

BRADY BRINKMEYER '16

### **Star Wars: A Cautionary Tale on the Overuse of Technology in Our World**

It seems new and improved forms of technology are always being incorporated into our lives in order to make us more comfortable and our tasks simpler. Although technology can be useful and beneficial for humanity, an overuse of it could take our lives out of balance. Science fiction films often incorporate stunning new technologies that seem futuristic and unattainable. George Lucas's *Star Wars* saga is no different and acts as a cautionary tale of the overuse of technology. To explore this idea further, I conducted a rhetorical criticism using the ideological method on George Lucas's ever popular *Star Wars* film saga. In this epic saga, we hear over and over again the importance of balance in the force of light and dark; however, this claim does not only pertain to the force. Although there are countless examples within the films, I will consider the relationship of technology between the light and dark sides of the force by examining elements within the films such as Darth Vader, General Grievous, and the Death Star along with Luke Skywalker, ObiWan Kenobi, and their droid counterparts, R2D2 and C3PO.

*Faculty sponsor: Derek Sweet*

SANDRA CARDENAS '16

### **Cultural Competency among Nursing Students**

As the United States becomes more culturally diverse, nurses, who are advocates and caregivers of patients, need to demonstrate cultural competence to provide holistic care. This training should be started early in nursing education to

give future nurses the opportunities to practice and integrate appropriate behaviors and practices. The American Association of Colleges of Nursing (AACN) defines cultural competency as “the attitudes, knowledge, and skills necessary for providing quality care to diverse populations.” The purpose of this project is to measure the cultural competence of nursing students within their class cohorts in the Luther College Nursing Department. This cross-sectional study used emailed surveys sent to current sophomore through senior nursing students (n=34) to collect data on their perceived knowledge, skills, and sensitivity regarding cultural competence. Findings revealed a difference between first-year and third-year and second-year to third-year nursing students. However, no difference was found between first-year and second-year nursing students. This result suggests that there is an element in the third year of nursing education that gives students increased self-perceived competence. Further research is needed to explore nursing students’ cultural competence at Luther College. Potential interventions may include a cultural immersion experience or implementation of a culture course curriculum.

*Faculty sponsor: La Donna McGohan*

SANDRA CARDENAS '16  
PHAREZ MONNEY '17, MEGAN  
NADING '16

### **The Fluctuation of Food Choices and Exercise Habits of Luther College Students throughout the School Year**

According to ACHA-NCHA II, Luther College consistently ranks higher than the national average in many aspects of nutritional and exercise-related indicators. Our research investigates this trend to determine what are the components of higher nutritional and exercise scores and what factors influence them. This research is a part of our Paideia 450 group project that investigates the nutritional choices and exercise habits of Luther students and inquires how academic, environmental, and social factors influenced eating and exercise habits throughout the school year. Subjects (n=22) participated in individual interviews conducted by researchers during January 2016. The transcripts collected were then coded for analyses of trends. We discovered that students’ eating and exercise habits were influenced by academic schedules (e.g., exams), social groups, seasons (times of the year), and residence hall location. Results indicated that tight schedules left little room for

meals, students ate less during finals week, and dorm location affected students’ motivation to exercise. Our recommendations took a holistic approach and included increased access to healthy foods options at the C-store, stress-relief activities, student dinners, and blocked lunch times.

*Faculty sponsor: Maryna Bazylevych*

### **SANDRA CARDENAS '16 Supplement Use within Old Order Amish Families with Hemophilia**

Biomedical healthcare providers use the term “complementary and alternative medicine” (CAM) to define any medical practices not considered to be conventional medicine, and understanding patients’ use of CAM is important in establishing effective plans of care. One community where CAM use is particularly prevalent is the Old Order Amish, and Amish patients with hemophilia, a genetic bleeding condition, may be at risk if natural remedies used by family members impact bleeding. Yet there is little current literature about CAM use among Amish populations with hemophilia to guide healthcare providers. The purpose of this investigation was to describe CAM used by Amish families with hemophilia. We conducted a literature review and, in collaboration with the University of Iowa Hemophilia Team, we collected primary data via mailed surveys to Amish families with hemophilia. Respondents reported using specific supplements to decrease bleeding, specific supplements to prevent fatigue, and other supplements to support general health. Our analysis reveals that many of the reported supplements lack consistent evidence in the literature to identify concerns related to bleeding. This study demonstrates the need for additional research and includes recommendations for more effective communication and creating effective plans of care.

*Faculty sponsor: Angela Kueny*

### **KRISTEN CARLSON '18 Polyphemus, the Creature, and Gregor Samsa: Three Monsters in Search of Humanity**

Non-human characters in literature can point to a common identity that humans share but that might not immediately be recognizable. In texts such as *The Odyssey*, *Frankenstein*, and Kafka’s *Metamorphosis*, the non-human characters reveal aspects of what it means to be human that very often are suppressed, ignored, or concealed. They also show that humans need those traits,

thoughts, and notions in order to fully understand themselves. By creating non-human characters, authors emphasize the intricacy of human nature and the ambiguity of what it means to be human. These characters—very often primarily defined as non-humans only by their outside appearance, sometimes also by behavior that society deems monstrous—force readers to ask themselves what it truly is to be human. When comparing and contrasting these three well-known texts, it becomes apparent that non-human characters exist in the narratives because they force the humans in these stories to reevaluate and define their own being-ness. The non-humans reveal humans' aspiration to be good, but also their full capacity to be evil. By exploring this possibility, readers can develop their own knowledge of identity and explore an expanded perspective of human nature.

*Faculty sponsor: Sören Steding*

EMMA CASSABAUM '16  
CIERRA BUCKNER '18, EMILY GARST '18,  
MAGGIE SULENTIC '16

***Predisposition: A Play about Memory***

*Predisposition* is the result of my year's creative work on a senior honors project: a two-act play focusing on three women as they work to understand inheritance in its many forms. Based on my own experiences with my grandmother and niece as well as interviews with other senior women, the show examines the illness of a parent and grandparent and the care associated, as well as familial responsibility and interracial adoption. For her senior project, Maggie Sulentic has taken on staging of the show. Our collaboration has yielded innumerable benefits, allowing the show to evolve and revise itself in workshop as Maggie, the cast, and I discussed the characters, dialogue, and plot itself as a creative team. To showcase our collaborative efforts, our presentation will offer a brief description of our creative process followed by a staging of selected scenes from the show. These scenes have been chosen for their significance in the show as well as the degree to which they were shaped by our rehearsal process. Following the performance, we will offer a talk-back, allowing the audience to provide feedback and ask questions.

*Faculty sponsor: Amy Weldon*

JENNA COURTNEY '16

***An Iranian Feminist Forever Abroad, and Her Navigation in the Purgatory between Western and Eastern Thought***

Shirin Neshat is an internationally recognized Iranian artist who currently resides in New York City under self-imposed exile. Neshat produces visual commentary on the political turmoil in Iran after the 1979 Revolution, highlighting the country's gender hierarchy. Much has been written about Neshat's feminist films and photographs, but few have shed light on how her work intersects with contemporary Western fears of Iran and the Middle East. According to political theorist Noam Chomsky, the "Iranian Threat" is an assumption within the West that the Iranian people are violent, hegemony-hungry, and currently developing nuclear weapons. This concept is a contemporary manifestation of Edward Said's theory of Orientalism. Like Chomsky and Said, Shirin Neshat explores the friction between the West and the East, Islamic women and men, the community and the individual, oppressor and oppressed, and nostalgia for what once was and present-day realities in Iran. Neshat's medium of choice has been black-and-white photography and film, such as her series *Women of Allah* (1997) and feature films such as *Turbulent* (1998) and *Women Without Men* (2009). My study unveils the parallels between Edward Said's concept of Orientalism, Noam Chomsky's investigation of the Iranian Threat, and Shirin Neshat's visual product of her dislocation from the East to the West. I probe the question of whether Neshat accurately reflects Iranian voices and whether it is possible and just to create work about the East from a Western lens.

*Faculty sponsor: Kate Elliott*

SHAYLA DEJONG '16

***Galileo and the Catholic Church: Man of Science or Devious Heretic?***

In centuries past, the Catholic church has used its authority to overpower those who call the Christian belief system into question. This authority was exercised in areas outside of theology, calling into question what sort of power scripture possessed in all areas of life, even the realm of astronomy and the heavenly realms. Galileo Galilei, a 16th-century astronomer, is the main character in Bertolt Brecht's controversial drama *Das Leben Galilei* (*The Life of Galileo Galilei*). Galileo challenged the Catholic church's authority to establish belief in a geocentric worldview when the physical world suggested

otherwise. With reference to the play, we address the conflict between Galileo and the Catholic church over the nature of the earth's rotation around the sun, an issue central to the fate of the main character in the drama. In addition, we highlight the authoritative struggle between the church's establishment and an individual scientist's discoveries. Based on important documents of the church's condemnation of Galileo, our poster shows the Catholic church's slow evolution from denying validity of Galileo's discoveries to accepting his work as an important part of faith and scientific understanding. These discoveries establish the important dialogue between the theological authority of scripture and scientific authority of empirical evidence as it has changed through time.

*Faculty sponsor: Ruth Kath*

DORJEE DHONDUP '16

RYAN BENNETT '16, ZACH STEKEL '17

### **RoomReserve**

In today's world, managing large quantities of data is a difficult task. Having an easy-to-use interface that helps to manage these data sets can be highly beneficial and save a lot of time and frustration. One task that many organizations may struggle with is the large amount of data needed for reserving rooms. Our project, RoomReserve, is an application that can be used by organizations to keep track of rooms that can be booked for short periods of time. Many different constraints must be considered when creating reservations, such as time of reservation, who is making the reservation, the purpose of this reservation, current occupancy status, reservation costs, and much more! To help create an easier process for administration and guests, we created a website that provides easy access to all of the above aspects in a well-laid-out user interface. Our presentation will showcase this website and describe the process we used to create it.

*Faculty sponsor: Brad Miller*

EMILY DUFFORD '16

### **Redefining Affluence: What We Can Learn from Off-the-Grid Families in Decorah, Iowa, about a Sustainable Future**

One of the greatest problems my generation will face is the environmental crisis. Societally, consumption levels are beyond what can be sustained into the future. If humanity hopes to live within our means long into the future, as a culture we must redefine our values, and soon.

Through an ethnographic account of the off-the-grid community in Decorah, Iowa, a culture that values sustainable living, I examine how this community has redefined what it means to live a good life and the challenges the community has faced in its endeavors to do so. Using what I learned from off-the-gridders, I will look at ways the United States and other Westernized cultures can implement similar ideals to reduce our impact on the planet. I argue that the time is now to start redefining what it means to live well, and the off-the-grid community in northeast Iowa provides a case study for understanding a possible route to a more sustainable future.

*Faculty sponsor: Anita Carrasco*

ERIN ELLEFSEN '17

JOHN DOORENBOS '16

### **Herd Immunity in Discrete Networks**

Because of recent outbreaks of some diseases, vaccination practice and policy has come to the forefront of public consciousness in the last couple of years. Vaccination research is an important area of study to better understand the most effective strategies for vaccinating a population. Vaccinations not only benefit the individual vaccinated, but unvaccinated individuals in the community also benefit indirectly from others' vaccinations since vaccinated individuals interrupt possible transmission routes for the disease. When enough of the population is vaccinated, herd immunity can be achieved. This occurs when enough of the population gets vaccinated that it stops the spread of disease, even among unvaccinated individuals. This research primarily focuses on using mathematical models to better understand how population network structures and disease characteristics affect vaccination thresholds required to achieve herd immunity. It also draws comparisons between our discrete network models and a more commonly used continuous model.

*Faculty sponsor: Kyle Fey*

KATELYN EVENSON '16

### **The Influence of Neophobia, Human Familiarity, and Human Attentional State on Eating Behavior in Blue Jays**

This study investigated the effect of neophobia (fear of new things) on eating behavior in blue jays. First, individual differences in neophobia were measured in a set of blue jays. Next, the amount of time to eat food in the presence or absence of a person was investigated. The person

could be either familiar or unfamiliar, and had different attentional states (looking at the bird, looking down, back turned, eyes closed). There were no correlations between neophobia measures and the time it took a bird to eat when exposed to manipulations of human familiarity or attentional state. However, the familiarity of the person had an impact on the time it took to eat in the experiment, while the attentional state of the human did not. Individual differences in time to eat were found for these two variables as well and will be discussed. It appears that our measures of neophobia were not good indicators of how a bird will perform in experiments in which they are exposed to humans. However, blue jays do take longer to eat food in the presence of an unfamiliar person.

*Faculty sponsor: Kristy Gould*

AARON FARGO '16

### **How the United States Should Tax Its Income**

This research examines the current United States individual income tax system to determine if it is accomplishing the goal of federal revenue collection, or if it should be replaced by a wealth-based tax or a flat tax. The history of the personal income tax in the United States aids the understanding of the complex and confusing current system. Although the current system is complex, has flaws, contributes to wealth inequality in the United States, does not produce enough revenues, and has many seemingly better alternatives, I argue that it is still the most appropriate form of taxation for the United States. A change and simplification of this progressive form of taxation is preferable to implementing a wealth-based income tax or flat tax because of the difficulties of passing sweeping tax reform, increasing taxes on the wealthy, and maintaining an egalitarian system of taxation. Research methods used in support of this argument are the analysis of Internal Revenue Service tax return data, the history of U.S. income tax policies, exploration of various tax reform proposals, and consideration of alternative systems of taxation.

*Faculty sponsor: Mona Nelson*

EMILY GEHLSSEN '16

### **Athlete Burnout in Young Females: Parental and Coach Involvement, Communication Patterns, and Body Distortion**

In our society, we experience many types of burnout, from our jobs, to school, to everything in

between. A type of burnout that seems to be on the rise in young people is athlete burnout. Many scholars have conducted research concerning emotions around athlete burnout in Division I student athletes or youth athletes. Student athletes at Division III schools are approached differently about athletics. But what specifically causes burnout to happen, and what are the effects? This study addresses some specific causes and effects of athlete burnout in Division III female athletes. It will ask specifically: What do female athletes at NCAA DIII schools reflect on as contributors and outcomes related to experiencing burnout in terms of communication, relationships, and body image? Using qualitative analysis of face-to-face interviews, this study sought to expand on our understanding of this question. Findings indicate that coach and parental involvement and relationships are a factor of athlete burnout. Additionally, distorted communication patterns and a skewed body image are common outcomes of athlete burnout.

*Faculty sponsor: Sarah Wilder*

MADELINE GEIER '17

### **Standing in Solidarity: An Analysis of How American Colleges Can Most Effectively Confront Islamophobia**

Due to recent events, Islamophobia is becoming an increasingly more visible issue in the U.S. The oppression, targeting, and segregation of Muslims and those perceived to be Muslim is arguably worse now than at any time since 9/11. This research aims to examine what we can do to end Islamophobia and stand in solidarity with Muslim citizens and residents. Specifically, it examines what American colleges have done to combat Islamophobia on their campuses and seeks to determine which of these methods are most effective. Primary research was conducted through interviews with individuals involved in these efforts to combat anti-Muslim bigotry at various collegiate institutions along with secondary research from news articles and data from organizations such as the Interfaith Youth Core. The findings of this research may help both Luther and other institutions of higher education better address and challenge Islamophobia and provide guidance for future actions.

*Faculty sponsor: Todd Green*

LINDSAY GETSCHEL '16

**Addressing the Climate Paradox: Strategies for Successful International Climate Negotiations**

Climate change affects the entire international community, yet it contains a paradox. The countries that contribute the most to climate change will be the most able to adapt to the difficulties it presents, while developing countries, which contribute little to the problem, will be the most damaged by it. For more than 25 years, the international community has attempted to address climate change and its paradox. However, most attempts at climate negotiations have been marred by disagreement, lack of concern, and tumultuous domestic politics. Therefore, there has been little substantial action in regard to the mitigation of and adaptation to climate change. This paper examines past international climate negotiations to determine the reasons for past failure. In addition, this study asks: What went “right” at the Paris 2015 talks, and how can we continue and improve this cooperation moving forward? This study consults multiple scholarly and professional sources on negotiation strategies and obstacles as well as the context and outcomes of all United Nations Framework Convention on Climate Change conferences. By identifying the problems in the current climate regime, it is possible to draft solutions and paths toward successful climate negotiations and global cooperation.

*Faculty sponsor: John Moeller*

PABLO GOMEZ ESTEVEZ '17

**“Lulito”: A Celebration of Childhood through Text Painting**

This is an oral presentation focusing on “Lulito,” my multilayer creative project. The goal is to present in detail the components of the project (a children’s book and a piano suite), to share my journey as author and composer, and to talk about its future in a way that musicians and non-musicians can comprehend. The presentation will be divided into three parts: pre-production, production, and post-production. During pre-production, I will talk about the genesis of the project, outlining the story and the script for the composition of the music. In production, I will go into details about my composition process, my goals, and my approach to it. I will present two or three scenes guiding the audience through an analysis of the music and the literature and how they interact with each other. In the last section, post-production, I will talk about the journey of working with Eliana Pérez, my collaborator in

New York, and the challenges we faced. Also, I will briefly outline the future steps of the project: a published book, a dance performance, and a performance/exhibition of the project.

*Faculty sponsor: Brooke Joyce*

RYAN GOOS '16

**Language Endangerment and Revitalization: The Case of Quechua**

In an increasingly globalized world, indigenous and minority languages are becoming obsolete and outdated in favor of the culturally and politically dominant “global languages” such as English, Spanish, Chinese, etc. In fact, some linguists claim that up to 90 percent of the world’s 6,000–7,000 languages will be extinct in the next century. This project aims to understand why language loss is an issue that needs to be addressed, why languages are dying so quickly, and how they can potentially be revitalized. I will assess these questions by looking at case studies of language revitalization programs across the planet and analyzing why they were successful or unsuccessful. I will then apply this information to the current situation of Quechua in Peru, Bolivia, Ecuador, and Argentina to predict if the language will grow into the future or suffer the same fate as thousands of other languages around the world. The main goal of this project is to bring attention to the linguistic rights of minority groups that are quickly seeing the disappearance of their native languages, and to explore which strategies are most helpful in preventing further language extinction.

*Faculty sponsor: Megan Strom*

KEZIAH GRINDELAND '16

**Malala Yousafzai: Western Media’s Interpretation of Muslim Voices**

As a young Muslim woman and activist advocating for women’s rights to education, Malala Yousafzai is a prominent figure in the Western world’s understanding of Islam. It is therefore important to understand how the Western media depicts Yousafzai’s religious identity, and how this depiction compares to Yousafzai’s own understanding of her religious identity as expressed through her speeches and writings. The purpose is to understand whether the effect of Western media depictions of “good Muslims,” such as Yousafzai, challenge dominant media representations of Islam as a religion prone to violence and misogyny. To do this I utilized five media sources, FOX, CNN, NBC,

NPR, and *The Daily Show*. They were selected for a variety of reasons, including representing a spectrum from conservative to liberal within the mainstream media, and outlets that were favored by consumers. My research suggests that Western media's use of Yousafzai's narrative perpetuates, instead of challenges, stereotypes about Muslims. This analysis does not speak to the intent of the media outlets but rather demonstrates the effect of the coverage of Yousafzai. This conclusion suggests that media narratives may struggle to present Islam as a positive motivating factor in the lives of prominent Muslims who are otherwise hailed as heroic and inspirational figures.

*Faculty sponsor: Todd Green*

KEZIAH GRINDELAND '16

**The Myth of Religious Violence:  
The Dichotomy between Religious and Secular  
Violence as a Reality or a Western Construct**

William Cavanaugh's *The Myth of Religious Violence* challenges the common Western assumption that religious violence is easily distinguished from secular violence. Cavanaugh suggests that the West employs this duality in order to justify militaristic and imperialist actions in non-Western regions and to delegitimize religious violence. The objective of this project is to analyze this theory within the context of the interactions between ISIS and the United States. I plan to determine whether this dichotomy exists within American political discourse and, if so, the extent to which this discourse reinforces the U.S. imperial project in the Middle East. In order to achieve this goal I will analyze media coverage from four media outlets, CNN, FOX, NBC, and NPR, which were selected for their widespread use and perceived levels of trust by American audiences. I will focus my analysis on the coverage of four stories revolving around ISIS between 2014 and 2016 and compare the results to Cavanaugh's *Myth of Religious Violence* in order to examine the accuracy of his theory.

*Faculty sponsor: Todd Green*

ERIK HAHN '16

**Exploring and Uncovering Heidegger:  
The Ontic/Ontological Distinction**

What does it mean to be a human being? An analysis of the history of the idea leads one to different possible conclusions: some say it means being a rational animal; others argue it means being a child of God; etc. To think of oneself as a human being is to think about oneself in a

particular way. In the 20th century there was a change, the existentialist turn, that states that "existence" precedes any "essence" of what it means to be a human being. Existentialism thus opens a space to investigate what it means "to be" as a necessary first step in addressing the question. In this presentation I will follow the methodology of Martin Heidegger, an influential 20th-century philosopher, to explore the issues of defining what it means to be human. Heidegger's early philosophy distinguishes between two types of investigation. One approach is the "ontic": an investigation into the "accessible facts" or descriptive characteristics of an existent thing. A second approach is the "ontological": an investigation into the meaningful structure of an entity's being. By analyzing Heidegger's discussion of the difference between these two types of investigation, I explore the meaning of being and posit an alternative answer to the question of the being of a human being that moves away from an essential definition to one based on presence.

*Faculty sponsor: Gereon Kopf*

JOSH HARPER '16

**We Were All Cheated: An Ideological Critique  
of the First Postmodern Video Game**

As video games continue to mature as a medium, we begin to find fascinating rhetoric with strong consequences for those who play them. One such game is *Metal Gear Solid 2: Sons of Liberty*, which is often hailed not only as the first postmodern video game, but one of the most controversial games ever released. Why was this game controversial, what makes it postmodern, and what message does it leave its players about their own identities? To answer these questions, I used ideological criticism to get at the postmodern heart of this artifact. This analysis reveals a message critical of its own medium and the effects that it has on identity formation and creation. The artifact suggests that we must be critical of the characters we willingly inhabit, and it offers a wider representation in our media of what makes someone a "hero."

*Faculty sponsor: Kimberly Powell*

WILLIAM HATUNGIMANA '16

**Mining and Development in African  
Countries: A Comparative Analysis**

This paper takes a semi-regional approach in attempting to explain the cause of underdevelopment in sub-Saharan Africa's mineral-rich countries through a comparative

analysis of four countries—Botswana, Zambia, Sierra Leone, and the Democratic Republic of Congo—according to their level of economic development (the best case, good case, improving case, and worst case, respectively). To explain underdevelopment in mineral-rich African countries, the first part of this paper explores some specific mechanisms of African (under-) development: institutional characteristics; development theories such as the resource curse and Dutch disease; and conflicts. The second part discusses the economic history and analyzes each of the four countries, presenting an overview of the analysis and discussing some similarities and differences between the countries. The analysis of the mineral-rich countries explains their level of development by showing existing strengths and weaknesses in their management of mineral resources. This paper provides an overall understanding of the underdevelopment in mineral-rich developing countries and presents a continuum that can accommodate any mineral-rich country in Africa to determine its development level. Mineral-rich countries with strong institutions and less susceptibility to Dutch disease will experience considerable economic development from mineral resource, while mineral-rich countries with weak institutions and susceptibility to resource curse will experience low economic development.

*Faculty sponsor: Pedro dos Santos*

KARIN HECHT '16

**Understanding the Partially Deceased:  
A Unique Portrayal of Mental Illness  
in BBC's *In The Flesh***

Past research has shown that media portrayals of mental illness can have a significant effect on the surrounding culture and audience perceptions. Largely, these portrayals have been negative, acting to increase the stigmatization of mental illness, and mental illness is rarely addressed, or only appears in certain genres. One television show in particular, titled *In the Flesh*, approaches the topic of mental illness in a rather unique way, presenting a population of medicated zombies whose treatment closely parallels those struggling with a psychiatric disorder. Looking at both qualitative and quantitative evidence throughout the show's nine episodes, each an hour in length, provides insight into a larger discussion about stigmatization of minority groups. By indirectly addressing these issues, and placing them in a fictional setting, *In the Flesh* introduces a new way to spread knowledge of mental illness and

raise conversation that could have an effect on audience perceptions. Results are discussed in terms of pros and cons for this method of representation.

*Faculty sponsor: Joe Breitenstein*

BRYN HEDLUND '16

**Focusing on Topic: The Use of the Left  
Periphery in Spanish**

When we talk, we tend to highlight certain pieces of information—a topic we're commenting on, new information we're providing, or something that contrasts with previous discourse. Syntactically, the left edge of sentences (also known as the left periphery) appears cross-linguistically to be a position used to make information of this sort particularly salient. The degree to which languages use the left periphery for topic and focus, however, varies. For example, Italian uses this position extensively, while English uses it only for contrastive focus. In this paper, I investigate the use of the left periphery in Spanish. Analysis of questionnaires and samples of spoken discourse from native Spanish speakers indicate that in contrast with Italian, Topic always precedes Focus and that the syntactic properties of Topic in Spanish are different. This knowledge provides a better understanding of the syntactic mechanisms our language faculty provides and the ways we use them to convey information. Additionally, this knowledge will contribute to the elaboration of a theory of syntax that accommodates both of these areas of language.

*Faculty sponsor: Laurie Zaring*

BRYN HEDLUND '16

**Persuasiveness through Pronouns in *Macbeth*:  
The Diachronic Evolution of English in  
Literature**

The English language has undergone a series of changes in its history, transitioning through three other forms of the language before getting to the Modern English we know now. So, why is this important, and how does it connect to Shakespeare and literature? Knowledge of these changes is paramount in order to understand the intricacies of Shakespeare's language and, more broadly, the language of literature through the centuries. After exploring the evolution of the English language from Old English to Early Modern English, I chose to focus on one linguistic change of particular interest during Shakespeare's time—the use of personal pronouns. I explored

how personal pronouns changed over time and how they are used strategically by the characters in *Macbeth* as tools of persuasion. A pioneer of Early Modern English, Shakespeare's choice of pronoun in *Macbeth* is both linguistically and literarily significant. By subverting traditional usage guidelines for second person pronouns, Lady Macbeth effectively persuades her husband to do what she desires and commands their interactions. Additionally, Lady Macbeth's and Macbeth's partiality for differing second person pronouns sets up a juxtaposition between these two characters with particular regard to their gender roles and moral standards.

*Faculty sponsor: Lindsey Row-Heyveld*

BENJAMIN HENSON '16

### **The Inclusion of Injury-Prevention Strategies in Beginning Violin Method Books**

This study was undertaken to analyze how injury-prevention strategies were incorporated into string method books, specifically violin books. Six violin method books were examined: *Orchestra Expressions*, *String Explorer*, *Suzuki*, *Sound Innovations*, *Essential Elements*, and *String Basics*. Injury-prevention strategies, as identified by other researchers and pedagogues, were grouped into six categories: left-arm technique, right-arm technique, posture, instrument accessories and sizing, practice habits, and stretching. Each method book was examined for the number of occurrences of each injury-prevention strategy. Each category of strategy was also examined by means of a rubric to determine the quality of the occurrences, as determined by completeness and image quality. Overall data for each of the method books were then compared. The study revealed that in general, method books incorporate some left- and right-hand technique instruction and very little if any of the other four categories of injury-prevention strategies. The highest-scoring method book for both occurrences and quality was *Orchestra Expressions*.

*Faculty sponsor: Jill Wilson*

DANIEL HERMAN '16

### **Modeling Apparent Stellar Brightening Events as Gravitational Microlensing**

Since 2003, Luther College students and faculty have collected telescope data in the field of view of the open star cluster M23. Roughly 1,600 stars are monitored every clear night from early March to early October. Statistical tests were developed to identify meaningful stellar brightening events

from 299 clear nights between 2009 and 2013. Out of the thousands of potential events, 44 events were rigorously inspected, yielding seven events that could be considered astronomical in nature as opposed to events arising from things such as satellites, cosmic rays, or frame misalignment. Of these seven, four were modeled as potential gravitational microlensing events that would arise from massive objects passing between Earth and the background star being microlensed. We then calculate the fraction of the galaxy's dark matter that would arise from such objects should these events be confirmed as arising from microlensing.

*Faculty sponsor: Jeff Wilkerson*

JESSE HITZ GRAFF '16

### **MEMS, Myself, and I: Understanding the Wear Mechanism of Silicon Oxide and Aluminum Oxide on the Nanoscale**

My work focuses on improving the durability and longevity of microelectromechanical systems (MEMS). These devices do everything from allowing your phone to know when you tilt it to telling your airbag when to deploy. While compact and practical, they still have significant complications, with the major one being their susceptibility to wear. The goal of my project was to study the wear of silicon oxide on aluminum oxide, two common materials for MEMS device construction. As it stands, scientists and engineers can confidently predict how the surfaces of large objects wear, but predicting how the surfaces of microscale objects will wear is much more challenging. I used an atomic force microscope (AFM), which can be thought of as an incredibly tiny record player. The AFM scans a tip shorter than the width of a human hair across a flat surface much the same way a record player scans a record. I used the AFM to induce wearing on the AFM tips at the nanoscale and then analyzed the wearing of the tip in an attempt to identify the wear process. Ultimately I determined that our known laws on the macroscale do not appear to apply at the microscale and rather that there are other wear theories that may be more appropriate.

*Faculty sponsor: Erin Flater*

EMILY HOLM '16

### **Children and Change: Engaging Christian, Jewish, and Muslim Youth in Interfaith Dialogue**

While today's religion scholars have made great strides toward interfaith engagement and

understanding, one key audience has largely been left unreached: children. Many people believe that children are not ready for weighty discussion of religion and conflict, yet a number of efforts have proven successful, and new efforts are under way. My project involved two parts. One was working at a summer camp called Kids4Peace, an international organization that brings Christian, Jewish, and Muslim youth together for intensive dialogue at multiple sites in the U.S. The second was an independent study project in which I researched interfaith efforts and developed a curriculum for churches to use with youth—a curriculum that is now being used by many churches in the ELCA. I have found that children are not only capable of interfaith engagement, but also necessary to the peacemaking process. Their stories are genuine and compelling, and their influence in ending conflict is farther reaching than many government-made peace efforts. When equipped with leadership skills and included in the conversation—when given a voice—children can become powerful forces for lasting change. Drawing on the work of scholars such as Eboo Patel and Susan Katz Miller, I will present practical methods for engaging Christian, Jewish, and Muslim children ages 11 to 15 in interfaith dialogue, and reveal their vital role in conflict resolution.

*Faculty sponsor: Todd Green*

KRISTIN HOUSHOLDER '16

KATELYN JANSSEN '16

**Slowing BMI Growth Trajectories in Primary-Aged School Children: The Northeast Iowa Food and Fitness Initiative**

Obesity continues to be a pressing health concern for children. The purpose of this project was to implement and evaluate a policy-, community-, and school-based food and fitness initiative aimed at slowing obesity growth rates in primary school children in a rural region. Data were from 4,101 grade K–5 school children. Ten school districts participated. Initiative work began in 2009, and children received 0–6 years of exposure to this work. Multilevel growth models were employed to examine K–5 BMI growth trajectories.

Students with 0–1 years of initiative exposure showed steeper growth in BMI ( $b = 1.02$ ,  $P < .001$ ) compared to children who had 2–6 years of exposure ( $b = .67$ ,  $P < .001$ ). K–5 BMI savings was 1.5 points (6 pounds) for median-height boys and girls. The current initiative offers considerable BMI savings across primary-school years. Future work should determine if early

benefits continue through adolescence and young adulthood. Policy that supports community and school early childhood interventions that deflect steep upward BMI trajectories may pay unforeseen benefits by adjusting social, personal, and perhaps even physiological parameters in ways that provide lasting protection against obesity.

*Faculty sponsor: Loren Toussaint*

DOMINIQUE ITANZE '16

**Determining the Binding of Environment Pollutants to Host Molecules Using Fluorescence Spectroscopy**

Furans, polychlorinated biphenyls (PCBs), and aromatic hydrocarbons (PAH) constitute a class of environmental pollutants known as persistent organics pollutants (POPs). The presence of these compounds in our water and soil system is a great concern to both humans and the ecosystem. Animal experiments have shown that these compounds have a highly toxic potential due to their stability, seven to 11 years' half-life, and their ability to be absorbed by fat tissue. Consequences range from damage of the reproductive and immune system to these species being known carcinogens. This study is basic research looking for a better method to detect POPs in water systems, especially at low concentration limits. Complexing molecules (POPs) to supramolecular architectures (cyclodextrins [CDs] and micelles) will give us a new way to investigate these pollutants in our water systems. To achieve this goal, the experiments utilized were different steady-state fluorescence techniques, quenching and binding studies, and 1H NMR (nuclear magnetic resonance) studies. Results suggest that certain compounds, different furans derivatives, xylene, and PCBs have a significant binding ability with the host molecules, SDS (sodium dodecylsulfate) micelles, and CDs. All the data provided further knowledge of environmental pollutants and the ability to detect them using cheap and readily available fluorescence techniques.

*Faculty sponsor: Olga Michels*

AVERY JAMISON '17

**Connecting the Visual and Performative: Merce Cunningham and Robert Rauschenberg**

The 1950s and '60s were a time of convergence within the arts. This time of collaboration was largely made possible by the artistic environment at Black Mountain College in North Carolina and further developed in the thriving art scene

of New York City. This paper delves into the multiple contributing factors, focusing specifically on choreographer Merce Cunningham's and artist Robert Rauschenberg's roles in facilitating the engagement between dance and fine arts. The methods employed to research this topic include close analysis of published scholarship on the various institutions, movements, and individuals involved in the arts as well as formal analyses of both dance and fine arts works. This synthesis finds that both Cunningham and Rauschenberg played vital roles in expanding the parameters of their respective fields and drastically reshaped the relationship between art and movement. This study of the close working relationship between these two artists and their disciplines allows us to understand more deeply the evolution of the arts as a whole in the last decades of the twentieth century.

*Faculty sponsor: Kate Elliott*

ANNA JEIDE '16

### **The True "Threshold of Revelation" in *Angels in America***

*Angels in America* takes place in the 1980s in the United States at the height of the AIDS epidemic, particularly within the gay community. This paper examines the role of the protagonist, Prior, a gay man living with AIDS, and how his identity as both queer and crip functions in the drama. By viewing Prior's disease through the lens of disability, this paper posits that playwright Tony Kushner validates Prior through his queer and crip epistemology as the true prophet of the text bearing the true prophetic message, which challenges the normative prophecy made by the Angel of America. By drawing on the field of disability studies, this paper supports the theory that Prior's prophecy can only be holistically understood by viewing his prophecy as both queer and crip as a response to the hegemonic, heteronormative, able-bodied voice of "America."

*Faculty sponsor: Lindsey Row-Heyveld*

HAILEY JOHNSON '16

SHANE O'LEARY '16, ANDY TODD '16,

EMILEE VELANDER '16

### **Teaching Empathy, Perspective Taking, and Inquiry**

This presentation will focus on four lessons taken from unit plans designed in the Advanced Social Studies Methods course. The participants used an action research approach to explore best practices for their future classrooms based

on of the work of Barton and Levstik (2004) and Grant and Gradwell (2010). The presenters used these works to create lessons that sought to expand students' historical agency, empathy, perspective taking, and inquiry. Hailey Johnson's lesson from a Holocaust unit assists students in applying knowledge they have gained over previous lessons through a simulation. With an emphasis on perpetrator and victims, students will make decisions in small "families" and go through different trials, increasing their historical empathy. Shane O'Leary has students examining different ways to interpret the Constitution utilizing Justice Brennan's talk at Georgetown University and *Brown vs. Board of Education*. In Andy Todd's lesson students will learn about the Lewis and Clark expedition and the different "people of the West" by taking part in a role-play activity as well as taking notes during a short lecture. Emilee Velandar's lesson plan engages students in a role-play, encouraging students to empathize with sentiments during the Great Depression regarding unemployment, while also exposing students to realities of white male dominance.

*Faculty sponsor: Dean Vesperman*

JENNA JOHNSON '16

### **Using Worms to Understand Iron in Disease**

Many late-onset diseases such as Alzheimer's Disease (AD) are characterized by altered protein processing including difficulty regulating the synthesis and degradation of protein. This disruption of protein homeostasis can lead to cellular damage and death, particularly in neurons. One contributing factor to disrupted protein homeostasis in these late-onset diseases is the accumulation of iron. This study examined interactions between iron and protein homeostasis using *Caenorhabditis elegans*, a small worm that shares many genetic similarities with humans. We hypothesized that altering iron availability would affect the health of the worms and impair protein homeostasis. Iron exposure decreased lifespan of wild-type worms and led to increased iron accumulation. In a worm model of AD, excess iron exposure led to significantly higher iron accumulation relative to wild-type worms. Consistent with increased iron accumulation, expression of the iron storage gene ferritin was also increased following exposure to excess iron in both wild-type and AD worms. However, excess iron exposure did not alter expression of key protein homeostasis genes *rpn-6.1*, *lgg-1*, and *hsp-60* in either wild-type or AD worms. Collectively

these results suggest that regulation of iron is altered in the AD worm model, although iron does not directly affect protein homeostasis but may act through other cellular processes.

*Faculty sponsor: Stephanie Fretham*

JENNA JOHNSON '16

**Investigating Protein and DNA Interactions: The BRG1 Bromodomain and Its Association with Nucleosomes**

Structural regulation of DNA is essential for proper expression of genes. In cells, DNA is wrapped around histone proteins to form chromatin. Histones can be modified through addition of small molecules such as acetyl- and methyl-groups. These modifications can be recognized by the SWI/SNF chromatin remodeling complex, a group of several proteins. A key catalytic protein in the complex, Brahma related gene 1 (BRG1), recognizes acetylated lysines, a specific amino acid on histone tails, through its C-terminal bromodomain (BD). The precise mechanisms for this interaction are not well understood, and evidence suggests that there are additional factors beyond the acetylated lysines that guide the BRG1 BD towards acetylated chromatin. Using in vitro cell culture and gel electrophoresis, we examined the effect of other DNA structures, and modifications also influenced the activity of BRG1 BD. We found that the BRG1 BD interacts with unacetylated histone proteins and unwrapped DNA in addition to acetylated lysines, suggesting that the specificity of the SWI/SNF complex is driven by several structural features of DNA.

*Faculty sponsor: Stephanie Fretham*

REED JOHNSON '16

**Passion in Science: A Case Study on the Process of Antibody Formation**

The sciences sometimes get a reputation as being emotionless disciplines in which the only thing students learn are the memorized facts on which they are tested. The goal of this presentation is to challenge that reputation. To do this, I use an exploration of the capabilities of the immune system as a case study to exemplify how our understanding of the natural world is something worth being passionate about. Specifically, this presentation will address the question of how your immune system is able to interact with the thousands of foreign particles you come into contact with on a daily basis. Using a review of the literature, I answer this question by

developing a model of how billions of different antibodies (the class of protein that interacts with these foreign particles) can be created from only three genes. The ability to interact with such a high number of foreign particles is only one specific piece of the power of your immune system, which is part of a much larger puzzle of the understanding of the universe that science has helped uncover. I hope you find it worthy of awe.

*Faculty sponsor: Jodi Enos-Berlage*

ASHLEY KAPPERS '16

**Only Children and Communication: Conflict in Adult Interpersonal Relationships**

Only children are commonly stereotyped for being unable to communicate effectively, which in turn makes it hard to communicate with them. This study discusses the question of adult only children and how they learn to manage and deal with conflicts in their friendships. Focusing on how family interaction teaches communication patterns, the study asked: What communication strategies have only children learned to engage in while maintaining interpersonal relationships? And how do adults who are only children learn to deal with conflict in communication? Using qualitative analysis of 20 college-aged only children, the study highlights the emerging themes related to how only children learn and actively communicate. The results of this study show that the development of communication patterns through childhood influence how the participants interact as adults. Specifically, results demonstrate how interaction with and observation of adults when they were children contributes to how they have made and maintain friends as well as handle conflict with peers and parents. By using previous studies as a reference, results indicate, based on interaction patterns, that the participants communicate the same or better as young adults with siblings but interact poorly in conflict.

*Faculty sponsor: Sarah Wilder*

JONATHON KAUPA '17

**Galileo's Improvement on the Telescope**

In the context of our reading German author Bertolt Brecht's controversial drama *Leben des Galilei* (*The Life of Galileo Galilei*), I investigated the Galilean telescope, which figures prominently in the play. It is the telescope that first brings attention to the scientist and eventually leads to his lifelong house arrest. Based on Brecht's portrayal of his main character, I looked at

the mechanism behind Galileo's instrument and explored the question: How significant was Galileo's improvement on the telescope in relation to scientific discovery? My research involved the examination of the distinct astronomical discoveries that he made, as well as the generalized mechanism of his telescope, or *Femrohr*, in comparison with both previous and later designs and expansions to the device. Galileo was undoubtedly one of the most significant figures of the scientific revolution during the early modern period. Yet, with the knowledge that Galileo's model was not an original invention but rather an improvement on a more primitive design, I found that Galileo's improvement on the instrument was not as significant as the astronomical observations he made with it.

*Faculty sponsor: Ruth Kath*

TAYLOR KINLEY '16

### **Linear Perspective: Masaccio's Legacy and Late 19th-Century Adaptations**

Linear perspective is a technique that has been used in art by masters from the 15th century up until contemporary and modern art. Although it was not developed by him, Masaccio, an Italian Renaissance painter, perfected the technique that would be considered the standard for painting for three centuries. This study will focus on two areas of the life of linear perspective: first, the context of the Italian Renaissance and Masaccio's use of it; and second, an abrupt shift in art that took place in the late 19th century that caused the adaptation and in some cases all-out rejection of linear perspective in favor of different techniques. This research will show that artists such as Cézanne adapted linear perspective to accommodate the changing atmosphere of art and the introduction of proto-cubism and art nouveau in the late 19th century. These findings will indicate that the traditional method of linear perspective that was used in the Italian Renaissance impacts other periods of art even if it is not used explicitly.

*Faculty sponsor: Kate Elliott*

LOGAN LARSON '16

TAD GUY '18, SAM HAEFNER '18, SYLVIA KAARE '17, AIDAN SCHMITT '17

### **The Electronic Percussion Carnival**

My show, *The Electronic Percussion Carnival*, is written for percussion quartet and electronics. As a composer, I wanted to see what would happen

when I combined classical music and electronic dance music. I have a deep fascination with both and wanted to improve my rhythmic skills, so a percussion show came to mind. I focused on six subgenres of this music that include electronica, dubstep, glitch hop, chillstep, house, and trap music. After researching each genre, I wrote the electronic track for each piece. For some pieces, I focused very directly on form; for others, I let the sounds guide me. What brought me the most challenge was finding the sounds I wanted. After writing all of the electronics, I put percussion over top by playing all the parts myself with the tracks. I experimented with different timbre combinations, in which the listener's attention is continually peaked. With my presentation I, along with my four percussionists, will take the audience on aural journey that puts the two very different worlds of classical music and electronic dance music into one cohesive collection of songs.

*Faculty sponsor: Brooke Joyce*

PATRICK LARSON '17

### **The Qualitative and Quantitative Dimensions That Shape the College Process**

A considerable body of research indicates that prospective students consistently cite economic value and affordability, academics, and "fit" as the three most important variables in a college selection choice. However, these categories are broad and not very helpful to college admissions offices. This project clarifies the quantitative and qualitative dimensions of the college decision criteria by studying prospective students at Luther College. Information was collected through a variety of channels, which resulted in more than 500 unique individual responses. First, surveys were sent to students who had been accepted to Luther, prospective students who visited Luther during the summer of 2015, and Luther faculty. Qualtrics was used to design the surveys and collect and manage the data. Additionally, on-campus interviews were conducted with prospective students and their parents in the summer of 2015. This presentation will discuss a number of significant findings from this study, including how prospective students rank the importance of factors such as the "availability of grants and scholarships" and "total cost to you after financial aid," dimensions of "fit," and the "religious affiliation" of the college. This research suggests that as a college of the church, Luther faces a challenge in articulating who it is as a college, given the risk that students may not

respond favorably to this information during their search process.

*Faculty sponsor: Steve Holland*

BLAKE LETNEY '16

### **Interaction between PI3K Pathway and Iron Homeostasis**

The highly conserved phosphoinositide 3-kinase (PI3K)/Akt pathway regulates growth and aging by positively regulating processes that promote growth while inhibiting the FOXO transcription factor that regulates growth-restrictive genes. A major negative regulator of the PI3K/Akt pathway is phosphatase and tensin homolog (PTEN). PI3K/Akt activity is inversely related to lifespan, however the precise mechanisms are not fully understood. Appropriate iron homeostasis is essential for appropriate growth and metabolic activity. This study used the small nematode *Caenorhabditis elegans* (*C. elegans*) to explore the relationship between iron homeostasis and PI3K/Akt activity. *C. elegans* were grown in varying iron conditions: normal growth media, growth media supplemented with 24mM ferric ammonium citrate, and growth media with 100uM of the iron chelator deferoxamine. Three *C. elegans* strains were used: wild type (WT), *daf-18* (mutation in *C. elegans* PTEN homolog), and *smf-3* (mutation in iron transporter). Young adult *C. elegans* were harvested, dried, and iron levels were measured using inductively coupled plasma mass spectrometry (ICP-MS). When grown in iron-supplemented conditions, *daf-18* mutant animals had higher levels of iron compared to WT and *smf-3* strains. This finding suggests direct interaction between iron homeostasis and PI3K/Akt activity.

*Faculty sponsor: Stephanie Fretham*

ALLURA LOTHARY '16

### **Does Developmental Generativity Predict Substance Use in Middle-Aged Adults?**

Previous studies in psychology have found a link between developmental standing and alcohol consumption. For example, identity standing has been inversely linked with alcohol consumption. This study examines Erikson's developmental stage of generativity and its link with alcohol consumption. The specific research question for this study is: Do different levels of success within the generativity developmental stage co-vary with different levels of substance use in middle adulthood? Through Amazon Mechanical Turk, 400 participants, ages 40–60,

completed questionnaires regarding their alcohol consumption as well as their levels of generativity. This study may demonstrate the relationship between relative levels of success navigating developmental crises in the generativity stage and substance use behavior. The primary implication of this research is to suggest the importance of substance use behaviors and their relationship with developmental status.

*Faculty sponsor: David Bishop*

CHRISTOPHER LOVAGNINI '16

### **Loving Thy Neighbor: Why Do Christian Communities in France and America Interact and Engage with Muslim Communities in Different Ways?**

In the last century several misconceptions have arisen concerning how religious minorities in France are discriminated against by societal structures that favor the Catholic church. As Americans we have witnessed a rise in Islamophobia in our society over the past couple of decades, and media stories such as French schools banning Muslim girls from wearing hijabs indicate that the modern French context is similar. While Christianity is sometimes used to exclude Islam from modern discourse of French national identity, data suggests that in France greater levels of participation in the Catholic church actually lead to a decrease in discrimination against religious minorities. This project poses the question: What accounts for the difference between the American context and the French context? Using observational research from interning for l'Association Socioculturelle des Jeunes Libyens in Tours, France (a town with strong Catholic affiliation), writings that address the historical progression of the role of religion in French national identity (Jean-Jacques Rousseau, Jules Ferry), and studies about trends in discrimination against Muslims in the West (Tariq Ramadan, Pierre Bréchon), this project demonstrates that the more frequently a Catholic French citizen attends services, the less likely that person is to discriminate against Muslims. This finding is significant because it challenges the common American belief that religious organizations are universally identical regardless of their context.

*Faculty sponsor: Robert Shedinger*

JEREMY MAAS '16

NAMUUN TSEND-AYUSH '17

### **“A Dog Has Died” for Violin Solo**

Inspired by Pablo Neruda's poem of the same name, I have attempted to create my own musical poetry. More specifically, I have written eight miniature pieces for solo violin, one for each stanza of the poem. Using a concise and serial tonal language, I hope to express the ideas I find in the poem and to (paradoxically) expand them through my series of momentary pieces. These pieces were written for and will be premiered by Namuun Tsend-Ayush.

*Faculty sponsor: Brooke Joyce*

ROBERT MANGES '16

### **Epistemological and Pedagogical Value of Human Dissection**

The human body is the site of the oldest philosophical and scientific inquiries. Philosophers have theorized the body as the locus of political, social, personal being. Yet the public remains widely ignorant of the inner workings and anatomy of our bodies. Through the practice of dissection we both learn the scientific information of anatomy and have the opportunity to theorize our relationship to our own body. This paper is an intersectional investigation of the practice of human dissection as a vital and unique system of learning. By incorporating current pedagogical research, philosophical argument, and anthropological use of narrative, it becomes clear that the academic practice of human dissection must be preserved. This paper integrates the eastern nondualism of Yuasa Yuaso, feminist philosophy of Elizabeth Grosz, and Maurice Merleau-Ponty's phenomenology to show how new understandings of human dissection can preserve and expand its value. Human dissection teaches a vital knowledge base, provides the locus of counterattack to the dualist assumptions of biomedicine, and is a personally fulfilling experience that connects abstract conceptual learning to lived experience.

*Faculty sponsor: Gereon Kopf*

MARFIANO MANUEL '16

### **Learning from a Women and Gender Studies Internship**

In this presentation I will report on my Women and Gender Studies internship that I completed in spring 2016. For my internship I devoted five hours a week to advocacy against domestic violence at Helping Services for Northeast Iowa.

Through weekly meetings we processed and researched what tools are needed to facilitate awareness at events created. I will report on three major things I learned: inclusion, giving people opportunity, and ensuring that people have safe space. From all the planning, research, and discussion, what I have learned is the importance of ensuring that survivors feel safe by creating awareness in the community for the purpose of changing the potential perpetrators' views rather than focusing on victim blaming. I will be using Dean Spade's book, *Normal Life*, to analyze the three major things that I have learned in my internship.

*Faculty sponsor: Char Kunkel*

MAKAYLA MARINACK '16

### **Jephthah's Daughter: Ancient Stories, New Voices**

This paper explores how the biblical account of Judges 11 has been interpreted at different moments in history through various types of media in conversation with different stories and contexts. Judges 11 tells the story of the Israelite leader Jephthah, who vows to sacrifice the first thing to come out of his house if he is successful in battle. His unnamed daughter becomes the unintended victim. This text has often been compared to the biblical text of Genesis 22, the story of Abraham almost sacrificing his son Isaac. This paper, through the method of contextual biblical interpretation, investigates how these stories have been understood together through four different forms of media and in four different contexts: the Septuagint (the Hebrew Bible translated into Greek, second/first century BCE); the visual art at the altar of St. Catherine's Monastery at Mount Sinai (seventh century CE); the musical work of Handel's oratorio *Jephthah* (1752); and oral discourse with a contemporary collaborative reading group of Luther College students (Nov. 2015). The ambiguous end to the story allows for many different interpretations. This paper will demonstrate that different contexts and experiences influence the interpretation of the vow and ambiguous sacrifice in Judges 11.

*Faculty sponsor: Kristin Swanson*

ASHLEY MEYERS '16

### **“A Transition Is like Having a Death without the Casseroles”: A Case Study of Gender Transition, Marriage, and Identity**

In recent decades visibility has increased for

many transgender people, and with this increased visibility scholars of varying disciplines have turned their attention to transgender issues. One topic in need of attention is trans-cis relationships. My research focuses on issues for couples in transition, specifically: How do transgender people navigate the realities of being closeted even to their intimate partners? How do partners of transgender people view themselves and their partner before and during transition? To answer these questions, I conducted oral history interviews with my grandmothers, JamieAnn and Peggy Meyers, who are a married trans-cis couple. Throughout this process I drew from scholarship on trans-cis relations along with my experiences as their granddaughter, covering topics including gender and sexual identity, married/family life before and during transition, and adjusting to JamieAnn's transition. Using the interviews alongside published scholarship, I was able to gain insights into Peggy's understanding of herself in relation to JamieAnn, the particular form of grief she has experienced at the loss of the husband she believed she married, how JamieAnn was kept closeted, and how she understands her own identity. As a case study, these findings add to our understanding of trans experience, the fluidity of identities, and the cultural belief in fixed identities.

*Faculty sponsor: Char Kunkel*

MARCELLA MEZA '18  
NATHANIEL HEMMING '18, KIERAN  
OKERSTROM '17,  
**Impacts of a Single-Turbine Wind Facility on Bat Activity and Fatality in Northeastern Iowa**  
Wind energy provides many environmental benefits, but bats are susceptible to turbine-associated fatalities. Learning more about these fatalities can help with developing strategies to minimize wind facility impacts on bats. Most studies have been conducted at large, multi-turbine wind farms, but few studies have examined the impacts of single-turbine facilities. Our goal was to investigate bat activity (via acoustic surveys) and mortality at the Luther College wind turbine, Decorah, Iowa. We conducted daily carcass searches and nightly acoustic monitoring from June 15 to Oct. 1, 2015. We used molecular techniques to verify species of carcasses found. We also deployed two types of acoustic detectors and analyzed the recorded bat calls to identify species present. We found a total of 35 carcasses representing 6 species. Number of recorded nightly bat calls was high, with little

brown bats being one of the most common species acoustically identified. Collectively, the data indicate a high activity of resident, cave-dwelling bats in the vicinity but also show evidence of migratory bat occurrence and fatality. Our data provides a current record of bat presence in northeastern Iowa and will inform potential mitigation strategies to reduce bat fatality at this single-turbine site.

*Faculty sponsor: Dawn Reding*

EMILY MUELLER '16  
**Application of Novel Sulfonamide Ligands in Selective Polymerization of Lactide**

In the United States we live in an economy and culture dependent on plastic, yet we have not successfully implemented methods to properly dispose of it. To counter increasing volumes of plastic waste, biodegradable plastics, like commercially available polylactic acid (PLA), have gained traction in recent years. Historically, one way to achieve this has been to use heavy metals, like tin, as catalysts for polymerization. However, these metals are often toxic, necessitating careful purification methods—especially for use in the food and medical industries. An alternative to using metal-based catalysts is to use specialized organic molecules, which has been accomplished, for example, with a class of thio-urea molecules paired with tertiary amine co-catalysts. This project explores the use of sulfonamide ligands, which have similar structure to thio-urea molecules, for the polymerization of lactide. This investigation has found that particular ligands function analogously to previously reported thio-urea molecules, but with less efficiency. This project has also revealed, contrary to previously reported literature, that the tertiary amine co-catalyst can perform polymerization unaided by the sulfonamide ligand. Future work may include determining the length of time required for full conversion of monomer to polymer and experimentation with alternate sulfonamides from the current library.

*Faculty sponsor: Brad Chamberlain*

MEGAN NADING '16  
SANDRA CARDENAS '16, PHAREZ  
MONNEY '17

**Stress and Social Support**

Based on the National College Health Assessment-Luther College Findings, stress plays a major role in daily life on campus. Prior literature suggests that social support can affect student

stress. This study's purpose is to investigate the relationship between social support and stress management. Through qualitative interviews, the research team asked students about their experiences and perceptions of how social support affects stress. Thirty-seven Luther College students voluntarily participated in this study. Participants included athletes, non-athletes, first-through fourth-year students, and students with or without a mental illness. The research team collaboratively analyzed interviews to identify common themes across participants. It was found that students utilized at least one person for social support in times of crisis but when given a realistic scenario kept to themselves and pushed through it.

*Faculty sponsor: Angela Kueny*

AUSTIN NASH '16

JAKOB JORGENSON '16, EHREN

KLUGE '16, EVAN WOODARD '16

#### **Project SAEJE: A Mobile Application for Musical Composition**

Musical composition is a complex task.

Composers often forget great song ideas before ever writing them down. To solve this problem, we have constructed a mobile application that automatically converts a sung tune into musical notation. Tempo control, chord analysis, and note editing functionality are some additional features. But is this all feasible on a mobile device? We chose to use Android, the most widely used mobile platform, as the operating system for our application, using the audio processing capabilities of an open-source app called *pTune* for pitch detection. Due to the complexity of audio processing, we encountered some obstacles such as the "negative pitch of silence" and the difficulty of determining when a sung note has begun and ended. Our findings hold broader implications for audio processing with Android and applications that modify or record input sounds in terms of musical notation. More importantly, our application serves to make composition more fluent, speeding up and enhancing the creation of new music. Our presentation will showcase this mobile app and describe the process we used to create it.

*Faculty sponsor: Brad Miller*

LAURA POST '16

ROBERT MANGES '16

#### **The Effect of a calR Mutation on Gene Expression in *Vibrio parahaemolyticus* under Varying Calcium and Iron Conditions**

In this study we investigated the organism *Vibrio parahaemolyticus*, a ubiquitous marine bacterium and major cause of foodborne illness in humans. We are interested in understanding how this bacterium senses and responds to environmental changes, including those that occur in ocean, estuary, and gastrointestinal habitats. Two elements whose levels vary in these environments are calcium and iron, and prior work in our lab has identified 45 *V. parahaemolyticus* genes whose activity is influenced by these elements. A protein, CalR (calcium regulation), has been identified that is involved in regulating a subset of these genes. We hypothesized that CalR suppressed gene activity under particular calcium and iron conditions. To test this, we introduced a calR mutation into *V. parahaemolyticus* strains and examined the effect of the mutation on gene activity under different environmental conditions. Eliminating CalR resulted in elevated expression of multiple genes, particularly under low calcium conditions. These data expand the CalR regulon and provide further support that CalR is a repressor that responds to calcium levels. This study is increasing our understanding of how *V. parahaemolyticus* responds to environmental signals, including those that might be contributing to its pathogenesis.

*Faculty sponsor: Jodi Enos-Berlage*

ISAAC PRICHETT '16

#### **Synthesis of a Compound to Control the Assembly of Biodegradable Plastics for Better Heat Resistance**

My senior research project was focused on synthesizing a molecule that would hopefully help control the assembly of poly(lactic acid) (PLA). PLA is a biodegradable plastic that has promise to replace a number of currently nonbiodegradable plastics in the market. The particular molecule that I am synthesizing has been reported to successfully control another reaction, so we thought it might have some effect on the assembly of PLA as well. I have simply attempted to recreate the molecule from the procedure provided in the original research. My work highlights the progress that has been made toward the final product and the subsequent modifications that have resulted in the procedure. The procedure involves five consecutive

reactions, and to date only the fourth reaction has been reached. Modifications have mostly included adjustments to purification techniques. Clearly, progress is being made toward the testing of this molecule's control over PLA assembly, which will be possible once the challenges in the procedure have been worked out and the last reaction has been performed.

*Faculty sponsor: Brad Chamberlain*

LAURA PROESCHOLDT '16

### **Spikes, Stakes, and the Anthropocene**

Is the collective human species now a force on par with powerful earthquakes, massive volcanic eruptions, catastrophic asteroid impacts, and devastating mass extinction events? According to scientists in favor of adopting the label "Anthropocene," a term proposed to describe the current geological epoch, the answer to this question is yes. The matter, however, is still up for debate as geologists, ecologists, and cultural scholars stake various positions. Supporters who are already using "Anthropocene" contend that humans indeed have the capacity to change the earth in ways that will be recorded in strata of soil and stone forever. Those opposed to the label argue that there is not yet enough objective evidence to make this claim. My project explores core documents and arguments in the debate in order to articulate what will determine whether or not we continue to use the term and to outline what's at stake in this decision. In my talk, I will wrestle with the question of why making the Anthropocene official matters to the scientific community and to academia more broadly and how it creates a dynamic space for rethinking relationships among science, politics, and activism.

*Faculty sponsor: Andy Hageman*

RACHEL REM '16

### **Persistence and Gazing at Humans during an Unsolvable Task Depends on the Age, Sex, and Experience of Pet Dogs**

When dogs learn how to open a container to get food, what happens when it is no longer possible to open the container? In this study, we looked at how long dogs continued to try to open the container and if they looked to a human for help or information. We tested 26 pet dogs on an unsolvable version (lid screwed shut) of a previously learned task that consisted of opening a wooden box's lid to retrieve food after demonstrations by a stranger, and in the presence

of their owner. Time spent away from the box was used as a measure of persistence. We found that dogs with no formal training (obedience, agility, or other) were less persistent than dogs that had formal training. Male dogs were less persistent than female dogs. Older dogs (five years or older) were less persistent than younger dogs (one to four years old). The more demonstrations on how to open the box that were needed during training, the less overall contact was made with the box. Finally, dogs that were obtained as pets from a shelter/rescue looked less at their owners than dogs obtained as pets from breeders, with a trend indicating that the age obtained (puppy vs. adult) may contribute to those results.

*Faculty sponsor: Kristy Gould*

SARAH RICKERTSEN '16

### **World-Building, Character Development, and Structure as Novel-Drafting Strategies**

My first book, *Battle of Three; or, Starswallower*, is a young adult fantasy novel with themes of political and religious rebellion and a dash of magic. With a full first draft already in hand, in this project I explored how to advance that first version closer to a polished, publishable product. Three critical writing elements that are crucial for development of an existing draft are world-building, character development, and structure. World-building is especially important in fantasy/fiction work, but all novels require research, planning, and execution in refining the social systems and structures of their fictional settings. The consistency and depth of characters benefits greatly in the development of a draft. And, while a first draft puts the depictions of action and non-action on the page, the revision stage opens space for experimenting with the order of unfolding these elements. My specific research included Jeff VanderMeer's novel *Annihilation*, China Miéville's novel *Kraken*, and Ursula K. Le Guin's book on writing, *Steering the Craft*. All novels need research and development in these three areas, no matter the genre. By studying specific writers and focusing on these elements, the revisionary development of a first-draft novel moves it significantly closer to submission for publication.

*Faculty sponsor: Andy Hageman*

KYLIE ROMEO '16

### **Evaluating the Sustainability of Luther College's Tuition Discount Rate**

Private nonprofit colleges have seen significant increases in tuition discount rates over the past decade. Tuition discounting is defined as the amount of institutional grants that offset the total cost of attending college. Increasing discount rates is utilized to increase enrollment and tuition revenue; however, studies show that revenues nationwide are slowly declining despite the increased rates. If private nonprofit colleges continue offering large financial packages without sustainable revenues, these institutions may experience detrimental financial issues and potential closure. Thus, this project researches whether Luther College is charging students enough by analyzing the sustainability of its discount rate. Net revenue changes will be compared to changes in discount rates for the 2006–7, 2009–10, and 2012–13 academic years to examine the correlation. Marginal costs, marginal revenues, and net revenues will examine the discount rate's effect on Luther's finances, hopefully determining whether Luther's revenues have adequately increased as a result of changing discount rates. If Luther's revenues are sufficient, then discount rates should continue to rise; however, if Luther's revenues are found to be insufficient, then significant alterations to Luther's financial packaging strategies must be made if Luther plans to continue for the next two decades (at a comfortable rate).

*Faculty sponsor: Mona Nelson*

TREVER SCHWICHTENBERG '17  
MATT DOSLAND '19, AMANDA EBY '17  
**Beethoven Piano Trio in C minor, Op. 1,  
No. 3 Mvmt I, III, IV**

Beethoven began his professional composing life with a set of piano trios. After years of working as a musician in both composing and performing, he officially published his first opus in 1795. It was a set of three piano trios. In hindsight, these trios were laced with mechanisms that would come to highlight his composing style. This style, which straddled classical forms and romantic ideas, revolutionized music. It was the commercial success of these trios that captured the attention of the public. The third and final trio is marked by a powerful sound throughout. The most subversive of the three, it was met with skepticism by those closest to Beethoven. Ultimately, it proved to be the most successful of the three. Performance of

the first, third, and fourth movements demands attention to detail as well as an understanding of the musicality Beethoven sought. In this session, our trio (Trevor Schwichtenberg, piano; Amanda Eby, violin; Matt Dosland, cello) will perform movements I, III, and IV of Beethoven's Piano Trio in C minor.

*Faculty sponsor: Virginia Strauss*

CLAIRE SEITZINGER '16  
**Controlled Polymerization of D,L-lactide with Titanium(IV) Tartrates**

As the world of biodegradable plastics expands, research must be done into catalysts (experiment drivers/assisters) that help reduce waste in polymerization (the creation of the chains of molecules necessary to make plastic) and create the most stable plastic the monomer (the individual chain links) can offer. Biodegradable plastic is an important area to explore, so that all of the uses of petroleum-based plastic can be covered. So far, PLA (poly(lactide)), the most common biodegradable plastic, has managed to replace several uses, such as that of plasticware and cold-drink cups, but there is room for research into how to organize the polymer in a way that would stabilize it for such uses as vessels for hot drinks. The most viable way to improve the stability is to have a catalyst that orders the polymer in a specific way. This characteristic of the catalyst is called stereoselectivity (or microstructure), which refers to ordering the direction the side chains of the monomer face. Therefore, this project focused on the use of titanium-based catalysts in polymerization to improve the stability of the plastic as a whole, as well as evaluating the kinetics of the reaction.

*Faculty sponsor: Brad Chamberlain*

ELEANORE SELL '16  
**Here Was a Woman: An Ideological Criticism of Gender Dynamics in HBO's *Deadwood***  
The HBO original series *Deadwood* (2004–6) narrates to modern viewers the people and events of the historical mining town of Deadwood, South Dakota, in 1876. As the men of the camp exert their power and assemble an informal government to prevent any laws from coming to Deadwood, the women are left to find and create a place for themselves. These women, of varying social and financial status, exert different ways of enacting their agency. Utilizing ideological criticism to examine masculinity and femininity in the Old West, my research examines how the show's four

main female characters gain and navigate power and agency within the camp. In examining their roles within *Deadwood*, quotes and visual elements as well as their interactions with men play a key role in understanding the various positions of these women within the camp. The ways in which these women navigate the masculine nature of the frontier positions them as a challenge to the hegemonic and rugged masculinity of the Old West. By examining traditional traits of masculinity and femininity and establishing where these women fall on the gender spectrum, my presentation will illustrate the significance *Deadwood* places on women as part of the Old West.

*Faculty sponsor: Thomas Johnson*

TRICIA SERRES '16

### **Effects of Increasing Core Body Temperature on Running Economy**

Running economy is the amount of oxygen consumed over a certain distance. The better running economy an athlete has, the less energy that person will use, and, therefore, the less oxygen will be consumed during exercise. Runners seek to be efficient so that as much of their energy as possible is utilized for faster and longer duration running. Performing any type of exercise increases core body temperature. Previous studies have concluded that temperature is a limiting factor of exercise, so this study was designed to assess the effects of increasing core body temperature on running economy. Ten trained distance runners performed a progressive run on the treadmill under two conditions. In one test, subjects began running from normal resting core body temperature. In another test, they were heated in a warm bath prior to exercise to elevate core body temperature 1°C. Core body temperature, VO<sub>2</sub>, heart rate, and lactate levels were measured. Preheating prior to exercise was associated with increased pre-exercise heart rate. Further, plasma lactate response to exercise was blunted with preheating. However, elevating core body temperature did not alter running economy. This study suggests that warming up prior to exercise may not affect running economy during submaximal efforts. Further research is needed on the effects of increasing core body temperature prior to maximal running tests.

*Faculty sponsor: Mark Eichinger*

AREN ST. LOUIS '16

HUNTER LYNCH '16, JUAN NAVARRO '16,  
DICHHA RAI '16

### **Norse Trip**

Do you wish you could have TripAdvisor customized for Luther students for study-abroad programs? Are you interested in what your fellow Norse classmates thought about the accommodations they used while studying abroad? To bring together the opinions of alumni, students, and faculty, our senior project group created NorseTrip. NorseTrip is a web service focused on the Luther student and faculty study-abroad experience. A particular concern was the students' opinion of accommodations used while abroad. Students and faculty can log in with their Norse key and write reviews of the places where they stayed, helping to inform and mold future study-abroad experiences. Any Luther community member can read these reviews and learn about particular study-abroad courses that may interest them. This web application, hosted by Luther's Center for Global Learning, allows for an all-around better understanding of what is to come in your off-campus study experience. Our presentation will showcase this app and describe the process we used to create it.

*Faculty sponsor: Brad Miller*

EMMA STIVERS '17

### **A Comparison of Butterflies on Remnant and Planted Prairies in Northeast Iowa: Species Richness and Diversity**

The goal of this project was to compare adult butterfly abundance and diversity between remnant prairies and planted prairies. Five surveys were conducted in four planted prairies and four remnant prairies in northeast Iowa during the summer of 2015. Researchers used a modified "Pollard Walk" technique following a meandering transect at approximately three-week intervals. Butterfly sightings were recorded using the Unified Butterfly Recorder (UBR) Android app. If a butterfly was observed nectaring on a flower, the species of flower was recorded along with its percent cover to measure floral resource availability and plant species abundance and diversity in each prairie. Planted prairies contained a significantly greater amount of floral resources than remnant prairies ( $p=0.021$ ), but there was no significant difference in plant species richness between remnants and plantings ( $p=0.312$ ). Remnants were found to have significantly greater butterfly species richness than planted prairies ( $p=0.03$ ), but remnant

and planted prairies did not differ significantly in butterfly abundance ( $p=0.15$ ). These results provide valuable information on the current status of butterflies in each prairie type and can be used in directing future land-management work.

*Faculty sponsor: Kirk Larsen*

SARAH STURM '17

### **Community Political Activism Related to Frac Sand Mining in Winneshiek County**

This project is a case study of citizen involvement in attempting to ban frac sand mining in Winneshiek County, Iowa. The study identifies two competing methods of community-based activism, including underlying constitutional arguments, and attempts to explain and evaluate the “winning” approach. The more radical approach uses the debate about frac sand mining to advocate a wholesale redefinition of how land-use decisions are made, with a heavy emphasis on community rights and control. The more traditional approach makes use of existing governmental channels and current regulatory zoning in seeking a way to ban frac sand mining. In addition to disagreeing on how local politics ought to work, the two groups reflect fundamentally different interpretations of what the U.S. Constitution requires regarding federalism and property rights. Although this constitutional debate is not central to the final resolution, it helps in understanding the competing approaches. The study draws from interviews with members of each group, the opinions of local citizens who engaged in the conversation by means of letters to the editor, documents collected by the Winneshiek County Board of Supervisors, newspaper accounts of the process in both Winneshiek County and surrounding counties, and scholarly writing.

*Faculty sponsor: John Moeller*

PETER SWANSON '16

### **Lasciate Ogne Speranza Voi Ch'intrate: An Original Composition Utilizing Screaming Vocals in Classical Music**

Writing for a chamber ensemble and screaming vocalist, I composed this piece as an attempt to bridge the gap between the worlds of classical music and modern metalcore music by using the extended vocal technique of metal. The piece uses a text by a current metal lyricist and employs contemporary composition techniques to unify the two realms.

*Faculty sponsor: Brooke Joyce*

ETHAN TAYLOR '16

### **Luther and Libation: Alcohol, Reformation, and Society in Early Modern Germany**

The German people have long held a reputation for their love of fermented beverages. The Reformation in particular stands out as a period of history in which drinking, tavern culture, and socio-religio-political discourse were commonly integrated. Martin Luther himself was a staunch advocate for the consumption of beer, delivering numerous opinions on the subject. This study attempts to answer a simple question: Did the brewing and drinking culture in early modern Germany accelerate the Reformation by providing a socially acceptable space (*i.e.*, a tavern) to discuss matters of reform and politics? Through primary source analysis and a small amount of brewing forensics, this study attempts to explain the relationship between alcohol and popular discourse in northern Germany during the Reformation. Additionally, the beer Luther preferred and frequently consumed (Einbeckerbier) will be reproduced to gain a better understanding of the technical and public health aspects of the brewing practices of the 16th century. Ideally this study will show a link between the social habits of the laity (in regard to alcohol consumption) and the rapid spread of Protestantism in Germany through interaction with reformers.

*Faculty sponsor: Robert Christman*

UYEN TRUONG '16

### **To Prevent Corporate Inversion: Tax Reform or Restrictive Measures**

U.S. pharmaceutical giant Pfizer announced on November 2015 a record-breaking \$160 billion merger with Irish firm Allergan, prompting concern about the controversial strategy of tax inversion many U.S. companies have used since the 1990s to reduce their federal income tax liability. Corporate inversions occur when U.S.-based corporations legally shift the address of their headquarters to a foreign jurisdiction to reduce their corporate tax burden. Corporations seek inversion because the U.S. corporation income tax system is the most far-reaching tax cost burden among developed economies. Corporations claim their competitiveness in the global market is limited by the tax burden. This study presents the debate over two major policies the U.S. government might pursue to curb inversions. The first option is a general corporate tax reform that attempts to make the U.S. more attractive to corporations by lowering the corporate income

tax rate or moving to a territorial tax. The second option is a direct target approach with legislative and administrative changes to make inversions more difficult. Using textual analysis of historical regulations and congressional reports, published books and articles discussing tax reform, and corporate reports on inversion plan, this research will argue which method option should be utilized to curb corporate tax inversion.

*Faculty sponsor: Mona Nelson*

NAMUUN TSEND-AYUSH '17

### **Adagio from J.S. Bach's Sonata for Solo Violin No. 1 in G minor**

American Protégé is an organization designed to offer opportunities and ensure successful careers for young musicians, actors, singers, and dancers. They organize several competitions that attract a large number of participants from all over the world. Winners receive recognition diplomas and a rare opportunity to perform in the world-famous Carnegie Hall in New York. I participated in the American Protégé Concerto Competition 2016 in the professional musician/college student category with Prokofiev's Second Violin Concerto and the first movement from J.S. Bach's Solo Violin Sonata in G minor and was selected as a first-place winner. This will give me an exciting opportunity to perform for the winners' recital in Weill Recital Hall at Carnegie Hall on December 18, 2016. The piece I am preparing to perform for the winners' recital in this inspiring hall is the Adagio from J.S. Bach's Sonata for Solo Violin No. 1 in G minor. Bach's collection of Six Sonatas and Partitas for Solo Violin is a cornerstone in the violin repertoire. Sonata No. 1 consists of four movements and clearly illustrates some prominent features of Bach's writing, such as his attention to the art of rhetoric, dance, and counterpoint. I am pleased to be able to perform the sonata for this year's Student Research Symposium.

*Faculty sponsor: Igor Kalnin*

DOUGLAS TUERS

### **The Role of Language in Shaping an Intellectual History of the Atlantic Slave Trade**

This paper will investigate the role of language in shaping the intellectual history of the Atlantic Slave Trade. I begin by providing a textual analysis of Book Five of Pliny's *Natural History*. If we take Pliny seriously, a narrative arises in how Europeans used the African slave as a kind of linguistic black hole, from which language,

once thrown in, could not escape. I will draw on literary texts such as *The Interesting Narrative* by Olaudah Equiano, Shakespeare's *The Tempest*, *Treatise on the Origin of Language* by Johann Herder, and recent works by Bruno Latour and Jacques Lacan. Overlaying this account of language will be a metafiction told from this language view of the interaction between Europeans and black Africans.

*Faculty sponsor: Richard Mtisi*

LAURA TURCO '16

### **The Brancacci Chapel: The Legend, the Inspiration, and the Controversy**

The Brancacci Chapel in Florence, Italy, is arguably one of the most important fresco cycles from the Renaissance period. It served as an inspirational mecca and unofficial school for artists such as Michelangelo and Leonardo da Vinci and helped establish many elements of importance within Western art. The frescoes' construction, divided among three artists, Masaccio, Masolino, and Filipino Lippi, presents an interesting conversation between three drastically different artists. Additionally, the chapel was subject to many misfortunes, so that by the 20th century, fires, earlier restorations, and the wear of time rendered the chapel a tragic mess. As a result, Italy's leading office of restoration, the *Opificio delle Pietre Dure*, conducted an intensive restoration with the goal of returning the frescoes to their former glory and original intent in 1984. Their results, however, were met with much controversy. In this paper, I investigate the controversial restoration of the Brancacci Chapel, analyzing the restoration process and the results to determine the ultimate success of the 1984 restoration in preserving this influential fresco cycle.

*Faculty sponsor: Kate Elliott*

ALES VARABYOU '17

SERGEI HANKA '17, MIRIAM HARRIES '16, KIRBY OLSON '17, JESSICA TAN '16

### **Lost and Found Application**

"Lost and found" items plague the administrators of every building on Luther's campus. In the midst of their busy days, administrators rarely have the time to effectively catalogue the items turned in to them. Unfortunately, the time saved by not documenting the items is later wasted by the necessity of manually searching through the collected objects the next time a student comes looking for something. The Lost and

Found web application was created as a solution to the challenge of tracking the multitude of found items all over campus. We intended to create a tool that would enable administrators to easily catalogue and search for lost items within and between campus buildings. To that end, development was focused around accessibility, ease-of-use, and efficient searching. In addition to its primary function, the application includes a limited search feature for non-administrators to check the possible locations of their items without the potential for “shopping” through the found items. Our hope is that the Lost and Found web application will transform the idea of “lost and found” on campus from a necessary evil to an effective system for locating and returning students’ possessions. Our presentation will showcase this app and describe the process we used to create it.

*Faculty sponsor: Brad Miller*

#### ALES VARABYOU '17 **Adaptive Computer Vision**

The majority of advanced noncommercial robotics projects face the issue of limited processing power provided by the popular boards such as Raspberry Pi. The issue correlates linearly with the complexity of the algorithms implemented, especially in visually guided projects. This research project describes the mathematical and programming aspects of designing an effective object detection control for robotics systems. The application comprises an onboard object tracking algorithm that relies on environment-dependent colorspace thresholding, and a server application that is primarily responsible for generating updated colorspace values based on processing hungry scale and rotation invariant feature detection and contour recognition algorithms. A custom TCP-based protocol was designed and implemented for the purposes of providing effective communication between the client and server applications. The protocol design also allows for better task handling as well as exchange of shared information across an array of clients. The complete project may be useful in the field of robotics by optimizing the workload typically given to a single machine into multiple tasks that can be assigned to both onboard as well as remote systems, providing high quality and performance system for adaptive control in vision-guided robotics.

*Faculty sponsor: Brad Miller*

#### KATHERINE VORDERBRUGGEN '16 **Constructing Independence: International Principles and the Status of Kosovo**

Since its unilateral declaration of independence in 2008, Kosovo has struggled to gain legitimacy as a state. Only 108 of the 193 states in the world have recognized Kosovo's claim of statehood. The difference in the international community over the status of Kosovo holds a basis in the conflicting principles of international law. In an attempt to overcome this political stalemate, the United States and its allies constructed a “special case” argument for Kosovo's right to secede that appeals to universal human rights and the right of self-determination. However, states have been able to maintain a position of non-recognition under the prevailing principle of territorial integrity. This paper considers the arguments and discourse put forward by states and illustrates how countries are able to employ international principles as they suit their political interests. In doing so, states continue to set the principles of self-determination and territorial integrity against one another, further perpetuating international disorder and global state fragmentation.

*Faculty sponsor: Pedro dos Santos*

#### DMITRY VORONA '17 **Russian Cultural Exceptionalism in Context of Foreign Policy**

The aim of my research is to identify the source of assertiveness in Russian diplomatic relations and alienation with the West, specifically the EU, under the first term of Vladimir Putin. The aspects explored include understanding of the state in Russian political tradition as well as the societal and political expectations that define the specific course of actions taken by the state during a time of political uncertainty. I used the literature on the theory of democratization to derive the origins of the first major conflict between Russia, Ukraine, and the European Union, known as the “First Gas War,” that followed right after the “Orange Revolution” in Ukraine. I argue that the coalescence of the Russian energy sector with the government through dubious legal means and concurrent constriction of private and foreign energy companies in the Russian business environment was a critical juncture for the increased assertiveness of Russian foreign policy during the first term of Vladimir Putin. The findings of my research challenge the common notion in international relations scholarship that the primary reason for Russian foreign policy

assertiveness was the increase in price of oil and natural gas.

*Faculty sponsor: Pedro dos Santos*

TIMOTHY WALCH '16

**The Changing of the Military: Galileo Galilei's Contribution to Changing Military Tactics**

Galileo Galilei is credited with the invention of many revolutionary devices. While often remembered for his contributions to investigations of the heliocentric model of the solar system, he also invented many instruments that changed the way the world worked. Galilei, the controversial scientist and inventor, is the main character in German author Bertolt Brecht's drama *Leben des Galilei (The Life of Galileo Galilei)*. In the context of our reading of Brecht's well-known play, I focus my study on the invention of the proportional compass and ask the question: How was the world, and especially the military, changed with the invention of this compass? To answer this question I looked both at items published by Galilei to explain the use of the device and at papers written describing the changes it made to the course of military tactics. The rising use of guns and cannons during this period meant that soldiers needed more precise calculations in order to be effective. While the compass was simply a money-making endeavor for Galilei, the instrument he invented also meant that soldiers with little formal education would be able to quickly and accurately determine the angles required to effectively use the weapons of the day. It is possible to see how influential this device was in improving military tactics in the early 17th century.

*Faculty sponsor: Ruth Kath*

JAYSE WEAVER '16

**Where's the Wear? An Analysis of Nanoscale Wear between Silicon and Aluminum Oxide**

When engineers design small devices such as microelectromechanical systems (MEMS), reducing material wear is critical. In this work, we report the nanoscale wear of silicon sliding against aluminum oxide at various loads in an atomic force microscope (AFM). The inverted tip shape of the silicon AFM tip is obtained by scanning the tip over a sharp-tipped sample. Rather than analyze this shape directly, blind tip reconstruction (BTR) is used to filter AFM images and create a three-dimensional tip reconstruction. As the tip wears, the apex becomes blunter. Wear is quantified by determining the blunted tip area

and plotting it against the distance slid across the sample. We expect blunted tip area to increase with distance, but the area sometimes increases or decreases in unrealistic ways. To avoid these trends, user-selected BTR parameters must be carefully examined. In this work, additional guidelines regarding BTR parameter selection are provided to help other researchers obtain more accurate tip shape data. Additionally, wear of silicon in contact with aluminum oxide will be analyzed to determine if it is consistent with macroscopic laws such as Archard's Wear Law or newer models developed for atomistic wear such as Reaction Rate Theory.

*Faculty sponsor: Erin Flater*

ELLEN WIDERSKI '16

MICHAEL ESPEY '16, ROBBIE NESMITH '17  
**Party Animal: A Social Music Experience**

We believe music is a social event that involves everyone. In creating Party Animal, we set out to implement an intuitive music manager driven by participation. Our web app is designed for individuals, whom we call DJs, who want a better way to allow their guests to influence their party's music. Guests can upvote songs that they like, downvote songs that they don't like, or suggest new songs to be added to the playlist. Party Animal makes it easy to create popular playlists, while still giving the DJ full control over its content. To create our web app, we use tools such as Express, Node.js, Socket.io, MongoDB, and YouTube. While these tools are very useful, many of them are still being developed and were lacking in complete documentation. Thus, implementing these tools was a challenging learning experience focused primarily on experimentation. Through developing this yearlong project, we were able to create a complete user-focused media player, as well as gain valuable experience implementing and integrating many new application tools. Our presentation will showcase this web app and describe the process we used to create it.

*Faculty sponsor: Brad Miller*

ANNE WILLEY '16

**Against the Great Destroyer: Prince Edward Island Medical Practice, L. M. Montgomery, and Dr. Gilbert Blythe**

The *Anne of Green Gables* novels by L. M. Montgomery enjoy popularity among readers internationally. Set on Prince Edward Island, Canada, in the late 19th and early 20th centuries, these novels leave impressions of that community.

One aspect of community portrayed in some detail is period medical practice on the island. At times, the practice is mentioned in passing, and at others, it is portrayed and discussed in surprising detail. My research asked: Is the medical practice portrayed by Montgomery, primarily through the character of Dr. Gilbert Blythe, an accurate historical representation of late 19th century and early 20th century PEI medical practice? To what degree do the novels romanticize actual period medical practice by promoting a particular kind of medical program? Using primary and secondary works about Canadian medical practice from 1880 to 1918, I compare the medical passages of Montgomery's works to the historical research in the different categories of medical practice to determine if similarities are present. This research offers insight about the role that children's literature can play in doing historical research, and it adds depth to the study of Montgomery's works. This research intends to show that her works, although fictitious in genre, possibly illustrate some aspects of island life with historical accuracy.

*Faculty sponsor: Jackie Wilkie*

JANE WILSON '16

**Plio-Pleistocene Climate Change: Insights from a New Sea Surface Temperature Record from the Southern Pacific Ocean**

Studying past climates is the key to better understanding the climate system of the present and future. One way to determine dominant trends in Earth's recent climate history is by analyzing sea surface temperature (SST) records generated from ocean sediment cores. This research investigates SSTs of the Plio-Pleistocene, a time in Earth's history of a shift from the warm, stable climate of the Pliocene (5.3 to 2.7 million years ago [Ma]) to the colder, more variable Pleistocene (2.7 to 0.01 Ma). We present the first southwest Pacific Plio-Pleistocene SST record of its kind in order to enhance understanding of southern hemisphere climatic responses to orbitally driven Milankovitch cycles. Specifically, we investigate the theory that a globally synchronous climate response to obliquity forcing emerged with intensification of northern hemisphere glaciation at ~2.7 Ma (Herbert et al. 2010), and the hypothesis that the mid-Pleistocene transition was caused by a change in the southern hemisphere response to precessional forcing (Raymo et al. 2006). This analysis extends our knowledge about the

southern hemisphere's response to orbital forcing during the Plio-Pleistocene and the connection of southern hemisphere climate change to the global climate system.

*Faculty sponsor: Laura Peterson*

ANDREA WOODBERRY '16

**Learning Collaboration: Resettling Hmong Refugees in Decorah, Iowa**

During the Southeast Asian refugee crisis caused by the Vietnam War, Decorah, Iowa, became a home to many forced immigrants including those of the Hmong culture. This study examines how a small, rural Iowa town assisted these refugees to achieve self-sufficiency within the United States. The project examines the experiences of those refugees and the Americans who helped them adjust to their new situation, while taking into account the cultural differences between the Hmong and Decorah communities. The study includes the medical, educational, employment, and citizenship needs facing this refugee community. Causes and solutions for each need are addressed based primarily on information from oral history interviews and original archival records. This data consistently shows the determination and collaboration of all parties that resulted in a successful model for refugee resettlement. Not only does this project provide a case study of refugee resettlement in a rural mid-American setting; it also provides a foundation for further research on Southeast Asian immigrants and their resettlement in Decorah. In a world where new refugee crises are arising daily in various parts of the globe, this case study provides important and relevant information for those seeking to serve current and future refugee communities.

*Faculty sponsor: Ed Tebbenhoff*

CASSIDY WOODS '18

**"Untimely Ripped"**

Readers and viewers of Shakespeare's great tragedy *Macbeth* have long wondered about the significance of Macbeth's nemesis Macduff being born by Caesarean section, that is, being from "his mother's womb untimely ripped." Why would Shakespeare use the revelation of a C-section birth upon which to turn the outcome of the play? This paper seeks to answer this question by looking at how Shakespeare's audience would have thought of Caesarean birth. The paper establishes that because Caesarean birth and those unlucky enough to be born by it were abhorred

by a general population shaped largely by popular myths, the procedure carried with it an aura of power, unconventionality, and sense of deep-rooted evil. Furthermore, the witches' prophecy (that "none of woman born shall harm Macbeth") gives Macbeth a false sense of security, since he cannot imagine being defeated by a foe born through Caesarean section. Going into the final battle, then, Macbeth assumes he is invincible, and Macduff is about to learn that he is due to his "unnatural" birth. After Macbeth boasts of his invincibility, Macduff, with a triumphant cry proclaiming his unusual birth, strikes down Macbeth. In this moment Shakespeare remarkably transforms the public's fear and awe about Caesarean birth into its opposite—not a source of evil but the very mark that makes Macduff the extraordinary superhero who alone can defeat Macbeth and restore order to a fractured world.

*Faculty sponsor: Martin Klammer*

KATHRYN YARWOOD '17

### **Supernatural Threats to Humanity Examined through Film**

When attending a horror film at the theatre or renting it, one is literally paying to be scared. Horror movies make up a sizable chunk of the movie industry, grossing more than 8 billion dollars from 1995 through 2015, with each individual film grossing an average of 18 million dollars. While many see horror as a genre to completely avoid, others seek a scare. Horror movies with immaterial evils (*i.e.*, demons) share key characteristics that realize some of humanity's common fears, including loss of control of one's own mind or psychological insanity, that coincide with a partial loss of individual identity as well as a fear of a death that doesn't let the soul leave the earth. While some commentators believe that many people enjoy horror films purely as entertainment, successful films of this genre are able to awaken universal fears. Drawing on broader study of nonhuman characters in film and fiction, this research focused on viewing and analyzing selected horror films, specifically those containing supernatural entities, and comparing similarities in these evils as well as what fears they "awaken" in audience members. To answer the question of what common human fears a successful supernatural horror film uncovers as well as how successful horror movies use this knowledge to elicit a scare, three of the 20 worldwide top grossing supernatural horror films ever will be used as examples.

*Faculty sponsor: Sören Steding*

YIFENG ZHANG '17

### ***Vibrio parahaemolyticus* Swarmer Cell Differentiation: The Polar Flagellum as the Sensory Organelle**

Surface colonization is widely used by bacteria as an essential survival strategy. These bacteria alter gene expression and behavior upon contact with surfaces. A central question is how do bacteria detect their physical environment? *Vibrio parahaemolyticus* (VP), which possesses dual flagellar systems, is our model organism to study surface sensing. In liquid, VP swims using a sodium-powered polar flagellum; on surfaces VP differentiates into swarmer cells and uses numerous proton-powered lateral flagella to move over surfaces. High viscosity or phenamil (a sodium channel blocker) interfere with polar rotation and induce lateral flagellar (*laf*) gene expression, suggesting that the polar flagellum is the surface sensory organelle. To determine the signal transduction pathway, we characterized loss and altered function polar flagellar mutants. All loss-of-function mutants behaved similarly with respect to surface sensing, including those with truncated, paralyzed, or no flagellum. They induced *laf* expression, producing the same effect as high load on the organelle, which suggests that surface sensing is not the result of mechanical coupling via force on the flagellum. The altered-function mutants could swim in the presence of sodium channel inhibitor. Some of these perturbed *laf* expression, implicating the sodium-driven motor in sensing. Importantly, there was no correlation between swimming speed and *laf* induction for these mutants, ruling out sodium flux through the motor being directly involved in surface sensing. Future studies will examine the motor configuration at the rotor in these mutants.

*Faculty sponsor: Jodi Enos-Berlage*

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