





# GW RESEARCH DAYS

## 2017

## ANNUAL RESEARCH DAY

**TUESDAY, APRIL 4, 2017**

---

### MARVIN CENTER

800 21ST STREET, NW, 3RD FLOOR

---

- |                             |  |
|-----------------------------|--|
| <b>8:30-10:00 a.m.</b>      | <b>Registration and Poster Setup</b> ( <i>Grand and Continental Ballrooms</i> )    |
| <b>10:00 a.m.-1:00 p.m.</b> | <b>Poster Presentations and Judging</b> ( <i>Grand and Continental Ballrooms</i> ) |
| <b>1:00-2:00 p.m.</b>       | <b>Poster Removal</b> ( <i>Grand and Continental Ballrooms</i> )                   |

### RESEARCH DAYS 2017 WEBSITE

**ONLINE** - <http://researchdays.gwu.edu>

---

- |                  |   |
|------------------|---|
| <b>5:00 p.m.</b> | <b>Poster Winners and Special Prizes Announced Online</b> |
|------------------|---|



## TABLE OF CONTENTS



Business  
Page 4



Creative Arts  
Page 12



Education  
Page 16



Engineering  
Page 39



Health Sciences  
Page 66



Humanities  
Pages 91



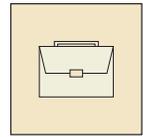
International Affairs  
Page 110



Natural Sciences and Mathematics  
Page 121



Social Sciences  
Pages 192



---

## SCHOOL OF BUSINESS

---

### Scholarly Impact on Management Education

We used bibliometric methods to define and measure scholarly impact on management education. We analyzed which sources, articles, and authors are most frequently cited in 21 widely-used organizational behavior (OB) and human resource management (HRM) textbooks. By extracting all endnotes and references, we created a database including 5,219 cited sources (e.g., peer-reviewed journals, business periodicals); 20,598 cited articles and book chapters; and 23,776 cited authors. Results have implications regarding the multidimensional nature of scholarly impact and the need to use a pluralist conceptualization and measurement of scholarly impact in designing performance management and reward systems for business school faculty, the science-practice divide, and the increased specialization and separation between management subfields. For example, there is no relation between journals cited most frequently in other journals and those most frequently cited in textbooks. In addition, about half of all sources cited in textbooks are non-academic, suggesting the absence of a noticeable science-practice divide in management education. Also, most research cited in textbooks was published within the last twenty-years, indicating that management education provides up-to-date knowledge to students (i.e., future practitioners). In addition, OB and HRM textbooks draw content from similar sources (e.g., peer-reviewed journals, business periodicals), but the specific content is very different. Taken together, results offer novel insights based on a more complete understanding of scholarly impact by using a definition and measure of scholarly impact on management education in addition to the more traditional and typically used measure of impact on research (i.e., citations in journal articles).

---

#### PRIMARY PRESENTER

---

Ravi S. Ramani

---

#### STATUS

---

Student – Graduate

---

#### AUTHORS

---

Herman Aguinis

Ravi S. Ramani

Nawaf Alabduljader

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Herman Aguinis



---

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

## Increased Internal Risk-Taking and Competitiveness in Biotechnology

This paper examines differences in risk-taking and competitiveness among biotechnology and pharmaceutical firms. It has been argued that biotechnology firms, in contrast to pharmaceutical firms, face higher levels of competitiveness and must pursue higher levels of risk-taking as a result. Using a sample of 40 biotechnology firms and 40 pharmaceutical firms, we analyze financial data, particularly research and development (R&D) expenditures, to assess the impact of levels of competitiveness and risk-taking. We discuss our results and implications for the literature on the management of R&D.

---

**PRIMARY PRESENTER**

---

Hannah Baxter

---

**STATUS**

---

Student – Undergraduate

---

**AUTHOR**

---

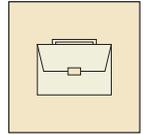
Hannah Baxter

---

**RESEARCH MENTOR/  
DEPARTMENT CHAIR**

---

Jonathon Mote



---

**COLUMBIAN COLLEGE OF ARTS AND SCIENCES**

---

## The Influence of Corporate Social Responsibility on Customer Loyalty in the Retail Banking Sector

This paper reports on a meta-analysis of fifteen international studies that report on results from research conducted on customer loyalty and corporate social responsibility (CSR) in retail banks. In terms of CSR, these studies include multiple domains, which are combined into four categories: environment, society, philanthropy, and ethics. This paper aims to examine the role of corporate social responsibility in determining the loyalty of customers in the retail-banking sector. By examining these fifteen studies through a meta-analysis, this paper identifies the general correlation between the two variables for all countries, the common effect (or variation) in correlation from one country to the next, and the component of CSR (environment, society, philanthropy, or ethics) that plays a larger role in forming customer loyalty in retail banks. In conclusion, the paper discusses the implications for the literature on CSR and customer loyalty.

---

**PRIMARY PRESENTER**

---

Gabrielle Fabre

---

**STATUS**

---

Student – Undergraduate

---

**AUTHOR**

---

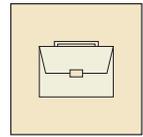
Gabrielle Fabre

---

**RESEARCH MENTOR/  
DEPARTMENT CHAIR**

---

Jonathon Mote



---

## SCHOOL OF MEDIA & PUBLIC AFFAIRS

---

### New Media in Latin America: Competitive Challenges and Opportunities within a Changing Media Landscape

As internet access expands throughout Latin America, new opportunities for regional and international news media are growing within the region. In response, new forms of media are emerging that capitalize on trends towards mobile and social-media based media consumption by heavily or entirely relying on platforms like Facebook and Twitter to deliver news media. These platform-driven news media are beginning to change the way we understand media competition both within the region and around the world.

The work of this research is to better understand the competitive challenges and opportunities of these new media and their effect on media competition within the region, grounded in research on the changing media landscape within Latin America. Their implications for the future of news media competition both within the region and globally are explained throughout this report.

This research incorporates first-hand experience and insights from leading audience development for Al Jazeera’s AJ+ Español, a new media organization based entirely on social media, operating internationally throughout Latin America. As well, insights and interviews are utilized from working with AJ+, Al Jazeera’s similar venture for English speakers, which was ranked highest globally for per-video engagement amongst social-media news publishers by the Reuters Institute for the Study of Journalism in 2016. Extensive market research was conducted in order to build on these insights and develop a detailed understanding of the relevant features of the communications landscape in Latin America. This research was used as a foundation for market research that helped launch AJ+ Español into the Latin American market.

Ultimately, platform-driven news media hold a variety of competitive advantages in audience development and engagement that are comparatively more relevant within Latin America due to unique factors in regional media consumption. However, key disadvantages increase the need for regional media to pursue hybrid strategies that do not over rely on the innovations of these new media. Throughout the world, these new media are setting the standard for the future of news media competition and while their organizational models are unsustainable in the long-term, they demonstrate key strategies for capitalizing on a changing media landscape in Latin America and throughout the world.

---

#### PRIMARY PRESENTER

---

Lenin Hernandez

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHOR

---

Lenin Hernandez

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

William Youmans

Frank Sesno

---

# BUSINESS

---



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Impact of Perceived Psychological Privacy on Stress

This research examines the degree to which perceived psychological privacy has an impact on employee stress in the workplace, mediated by extraversion. Perceived psychological privacy was defined as the sense that one has control over their interaction with others in the workplace. An online survey, investigating perceptions of privacy and stress at work, was distributed to 105 MBA students in a large city on the East coast. Using this data, we explore the relationship between perceived psychological privacy and employee stress. Results are discussed in terms of their implications for organizational management and future research.

---

#### PRIMARY PRESENTER

---

William Low

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHORS

---

William Low

Jonathon Mote

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Jonathon Mote

---

# BUSINESS

---



---

## SCHOOL OF BUSINESS

---

### Approaches to Entrepreneurship Education: A Qualitative Review and Comparison of the U.S. and Canada

We present a qualitative review of the state of the field of entrepreneurship education in North America, in which we examine such topics such as the growth of field, its attempts to differentiate itself from traditional business education, and current learning approaches and methodologies used in the classroom. We supplement this review with an analytical examination in which we present the results of a cross-country survey of over 200 entrepreneurship education programs in the United States (U.S.) and Canada. Our results reveal important similarities and differences regarding entrepreneurship education between the U.S. and Canada in terms of course content, pedagogical approaches and learning materials used, sources of funding, and measures of the impact of entrepreneurship education. We discuss implications of these results and outline future directions for the field of entrepreneurship education.

---

#### PRIMARY PRESENTER

---

Nawaf Alabduljader

---

#### STATUS

---

Student – Graduate

---

#### AUTHORS

---

George Solomon

Ravi S. Ramani

Nawaf Alabduljader

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

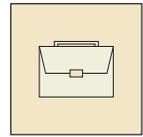
---

George T. Solomon

---

# BUSINESS

---



---

## SCHOOL OF BUSINESS

---

### V-Fashion

In Vietnam, many parents living under the poverty line send their children to work, instead of providing them an education. In a survey conducted by World Bank, basic literacy and numeracy skills have supported Vietnamese people in rural areas to increase productivity from low to high levels. According the CIA World Fact Book, only 10 to 15 percent of the children can move beyond third grade. One in every six children is engaged in working, with more percent of boys than girls. One third of them work because of necessity, and one fourth of them work because of income for living. The International Labor Organization stated that 1/10 Vietnamese youngsters are in child labor. 1.75 million Vietnamese children are currently employed. Approximately 569,000 children have to work more than 42 hours per week, which will affect their schooling as most of them do not attend school.

This project is called V-Fashion with the purpose is to provide access to employment to families in poor rural areas in Vietnam, so that they have the income to send their children to school. Minh Tran discovered that Vietnamese people in different rural areas possess different skillsets that could be utilized to generate income. For instance, the founder was able to determine that the parents in a specific rural area in Vietnam possess high knitting skillsets that are only used for family purposes, instead of generating income. There are several questions that Minh Tran would like to address:

Are there any other skillsets available in the poor areas of Vietnam that have not been discovered?

What are the methods to utilize those skillsets to generate income?

What are the employment opportunities available based on those skillsets that have been discovered?

V-Fashion is committed to reducing the child-labor rate in Vietnam by providing these parents employment opportunities to produce such products as knitted products, including hats, scarves, and gloves, in their own house. These products will be sold in developed markets for premium prices. The purpose of this project is to discover the methods and standardized processes to utilize their skillsets and possible employment opportunities to generate high income. At the end, when these parents can generate income for their families, they will be able to send their children to school, hence decreasing child labor rate and increasing literacy rate.

---

#### PRIMARY PRESENTER

---

Minh Tran

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHOR

---

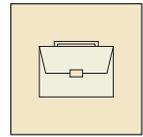
Minh Tran

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Lex McCusker



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Patterns in Financial Market using Machine Learning

To find the useful patterns in the market has always been focus of many researchers and traders. However, according to efficient market theory, prediction is difficult because the market price already incorporates some sort of information.

This paper is going to reports research in the following aspects. Firstly, whether we could use available information for forecasting stock/return or future price/return and has any interesting patterns. Secondly, whether we could use available information to forecast or get interesting patterns of the spread and do some statistical arbitrage. Thirdly, different machine learning represents methods can model different theory principles. For example, neural network mimics the way a biological brain solves problems with large clusters of biological neurons connected by axons together and CNN (Convolutional Neural Network) is a type of feed-forward artificial neural network in which the connectivity pattern between its neurons is inspired by the organization of the animal visual cortex. In deep learning, there are many layers between the input and output, allowing the algorithm to use multiple processing layers, composed of multiple linear and non-linear transformations. From the differences among machine learning methods and the predicting ability of each method, we can seek some understanding of which mechanism in neural networks plays a more important role in predicting financial market.

---

#### PRIMARY PRESENTER

---

Rong Zhu

---

#### STATUS

---

Student – Graduate

---

#### AUTHORS

---

Rong Zhu

Larry Medsker

Edwin Lo

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

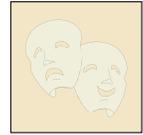
Larry Medsker

Edwin Lo

---

# CREATIVE ARTS

---



---

## CORCORAN SCHOOL OF THE ARTS & DESIGN

---

### A Journey Through “Inside Out”: A Children’s Exhibition Exploring the Purpose of Emotions and Learning How to Embrace Them

Many educators and parents would agree that the promotion of emotional health is important for children. However, very little is done to specifically develop emotional health in young children. Children are seldom taught the important skill of understanding one’s emotions and how to appropriately cope with them. The Pixar animated film, “Inside Out”, attempts to do just that, while also entertaining their audience. Through imagining the basic emotions as cartoon characters in the mind of a child, Pixar explores the purpose and development of emotions and how to appropriately express and cope with difficult emotions through challenging times.

While the movie was both educational and entertaining, a Pixar movie has certain limits in its ability to convey important lessons. It cannot dwell on more educational issues for too long as it must tell a compelling story in a relatively short amount of time. Audience interaction with the movie is also limited. However, an exhibition is less limited by time and can explore educational topics more thoroughly. Visitors can also set their own pace while going through an exhibition and can spend more time in certain parts of the exhibition to dwell on topics longer if they choose. The goal of my research and design project is to see how an exhibition can be designed to provide an immersive experience with interactives that physically engage a visitor in ways a movie cannot and still educate the visitors in a meaningful and creative way.

The design of the exhibition aims bring out both the fun and entertaining parts of the movie, “Inside Out”, and emphasize the more educational elements of the movie regarding emotions and explore the science of emotions that went into creating the movie. Elements used to inform the design of the exhibition, such as audience methodology, site considerations, precedents, interpretive strategy, and design strategy have been researched and taken into account. The final exhibition design will incorporate the important purposes of emotions, as shown in the movie, while using interactive features of a physical exhibition to further expand and instill the positive messages about emotions.

---

#### PRIMARY PRESENTER

---

Hsin-Yen Lin

---

#### STATUS

---

Student – Graduate

---

#### AUTHOR

---

Hsin-Yen Lin

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Clare Brown

---

# CREATIVE ARTS

---



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Posture as Performance Art: The Role of Persona in Louis XIV's Pursuit and Maintenance of Power

Louis XIV was a great patron of the arts during his reign, but perhaps the most fascinating artwork he curated was his own public image. Louis XIV (commonly called “The Sun King” due to the splendor of his court and the near-absolute power he held) inhabited a persona of himself distinct from his genuine self. With high heels, towering wigs, and a physicality to his movements that domineered over those around him (not to mention opulent architecture in which to stage his performances), this “Sun King” persona allowed a 5’4” man to become a larger-than-life monarch. This study examined Louis XIV’s life and monarchy through the lens of a continuous performance art piece, with the goal of drawing movement inspiration from the “Sun King” persona in preparation for choreographic work.

To do this, a three-week intensive movement study was conducted in London, England, and Paris, France. Textual and object-based research was undertaken at the Victoria & Albert Museum and the Louvre, consulting descriptions of life in Louis XIV’s court and how the “Sun King” persona enabled the consolidation of political power. Architectural research was undertaken at the Grand Trianon, the Gardens of Versailles, and the Palace of Versailles to determine how his environment influenced his persona. Improvisational movement was undertaken and filmed at all five sites, documenting the intersection between action and environment in real time.

The result of this study was a nine minute dance piece presented through the GW Theatre & Dance Department on the intersection between performance and political power. By taking an unstaged, lived performance and reframing it within an explicitly theatrical environment, the inherently performative nature of Louis XIV’s self-presentation was deconstructed and examined outside of its original context.

---

#### PRIMARY PRESENTER

---

Linda Ryan

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHOR

---

Linda Ryan

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

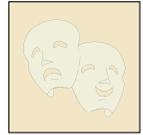
---

Maida Withers

---

# CREATIVE ARTS

---



---

## CORCORAN SCHOOL OF THE ARTS & DESIGN

---

### Green Your Mind

This thesis proposal for the exhibition titled, Green Your Mind explores the importance of reconnecting with nature to better the health and well-being of humans. With the development of technology and urban living, our awareness and feeling of connection to nature has diminished. Nature has the ability to elicit a restorative response for humans, which allows an opportunity to reconnect with nature.

The proposed exhibition will demonstrate how transformations can be prompted in the way we think about our environments and our relationships with the natural world. Bringing nature into cities will provide a healthier balance for humans.

Visitors will have the opportunity to interact with natural elements by using many of their senses in order to experience the physical and psychological benefits from nature. Incorporating nature into everyday life can decrease stress, anxiety, and depression while also increasing a person's health and happiness.

---

#### PRIMARY PRESENTER

---

Ashley Scutari

---

#### STATUS

---

Student – Graduate

---

#### AUTHOR

---

Ashley Scutari

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

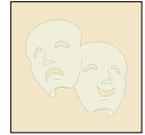
---

Clare Brown

---

# CREATIVE ARTS

---



---

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

## Empowering the Inconvenient: An Examination of Parisian Democratic Theater

According to John McGrath, “one of the great services theatre can perform for the people...is to be the instrument of authentic democracy, or...to push the community as near to authentic democracy as has yet been achieved.” Democratic Theater, known in earlier incarnations as Theater of the People, is a form of cultural democratization that infuses theatrical performance with political concepts, critiques and ideologies. It seeks to transform the space in which it is being performed into a political forum, a place where real societal issues and concerns can be safely discussed and explored by the performers, and simultaneously be absorbed and reinterpreted by the audience. Although the motivation of democratic theater is undoubtedly clear in theory, it may be rendered inert when wrapped in the ornamental trappings of a high art, i.e. the traditional venues and the avant-garde ideology that simply cannot be defined as accessible to all.

Using performance and architectural research conducted in Paris as its base, this paper begins by asking: when it comes to the city of Paris, has the movement that began as Theatre of the People ever truly achieved egalitarian, democratic performance? Without the goal of legislative action, how might a performance’s democratic success best be measured, if success is even calculable?

In order to affect palpable societal change, it is argued; a performance that is truly politically alive must live in an accessible space. It must live in a space that strikes a careful balance of entrancement and truth. It must live in a space that empowers, welcomes, listens and equalizes. A performance can only be considered truly democratic when it exists within a democratic performance space. But does such a space exist?

In attempting to discover answers, two different works staged at the Theatre de la Ville are analyzed for their tendency toward democratic performance: the 2011 theatrical production *On the Concept of the Face of Christ* by Societas Raphaello Sanzio and Anne Teresa De Keersmaeker’s *La Nuit Transfiguree*, a contemporary dance performance from 2016. The Theatre de la Ville itself is also examined as a structure designed to encourage democratic performance, and compared against the designs of and performances held in traditional Parisian theaters.

---

**PRIMARY PRESENTER**

---

Marissa Walker

---

**STATUS**

---

Student – Graduate

---

**AUTHOR**

---

Marissa Walker

---

**RESEARCH MENTOR/  
DEPARTMENT CHAIR**

---

Mary Buckley

---

---

# EDUCATION

---



---

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

## Early Childhood Educators: An Exploration of Professional Development using Washington, D.C. as a Case Study

Early childhood is a critical period for children’s cognitive and socio-emotional development because it is the time when working memory develops, the brain has the most plasticity, and children can experience the greatest gains in learning. Thus, early childhood education is beneficial for children, especially children from marginalized communities. Early childhood educators (ECE) play an important role in fostering children’s development. While there is an abundance of information regarding on-going professional development and teacher training among kindergarten through twelfth grade teachers, little is known about early childhood educators who teach children between the ages of zero and five. Because ECEs affect children’s immediate and long-term developmental and educational outcomes, it is important to understand how ECEs are educated and what professional development opportunities they have. Thus, the purpose of this mixed-methods research is to explore pre-service and in-service training and educational experiences of early childhood educators in Washington, D.C. Online surveys were distributed to early childhood educators across the city, and then semi-structured interviews were conducted with survey participants who indicated interest in participating. Interviews were transcribed verbatim. Survey responses and transcripts were analyzed and coded for central themes. Initial findings shed light on the current educational and professional development opportunities among early childhood educators in D.C., which will be presented and discussed. Ultimately, this research provides insight into early childhood educator experiences, which can be used to inform future education and professional development opportunities so that ECE are better equipped to foster children’s development.

---

**PRIMARY PRESENTER**

Abigail Marco

---

**STATUS**

Student – Undergraduate

---

**AUTHOR**

Marco Abigail

---

**RESEARCH MENTOR/  
DEPARTMENT CHAIR**

Emily Morrison

---

# EDUCATION

---



---

## COLLEGE OF PROFESSIONAL STUDIES

---

### Optimizing IT Usage at West African Research Center (WARC) in Senegal and World Vision in Guatemala

In this research project we worked on examining the technology readiness and capabilities of two academic research centers in Africa and Guatemala. Through a six-month long investigation phase, we assessed the technological capacity of these centers through the development of a survey based assessment tool. This survey/tool was then deployed at World Vision elementary schools in Palestina, Guatemala and at West African Research Center (WARC) in Dakar, Senegal. We also visited the centers to further investigate the IT needs and collect relevant data. In the final phase of the project, we are in the process of developing a program that could annually send GW students to World Vision schools in Guatemala and to the WARC center in order to implement and/or teach information technology to the local communities. Our deep-rooted connection to the culture, our personal upbringings, and our site-visits have been the driving force to expand the scope of our projects.

At WARC, we discovered that the center has the following needs: a faster and more reliable wireless local area network; an internet domain for the center; the modernization of the center's website; an interactive library database and subscription software (Integrated Library System); the installation of a secure server; and an affordable telecommunication mean to connect with employees in other countries of the West African diaspora. The World Vision schools need computers for the classrooms and an up-to-date Information Technology curriculum for the students.

Future work entails providing recommendations based on the technology assessment data we have collected and establishing a collaborative partnership to host future GW projects in Guatemala and Senegal where GW students can contribute and implement technical skills in specific projects. In the case of WARC, every year a student or group of students could visit the center and focus on a specific project. We are now in the process of identifying projects based on the needs of the center. In the case of World Vision Guatemala, we plan on acquiring funds to begin the process of purchasing and collecting computers that can be used to open computer labs at the participating schools. This will allow the students to have a base knowledge of latest technologies being developed in first world countries. In order to reach that goal, every year a student or group of students will visit Guatemala to help establish a computer lab. So far, we have acquired 20 computers for such purposes.

---

#### PRIMARY PRESENTER

---

Daniel Alvarez Castegnaro

---

#### STATUS

---

Student – Undergraduate

---

#### CO-PRESENTER

---

Roberto Solorzano

---

#### AUTHORS

---

Daniel Alvarez Castegnaro

Roberto Solorzano

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

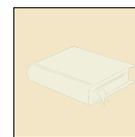
---

Olivia Blackmon

---

# EDUCATION

---



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Pedagogical Methods in Intermediate Laboratory

Undergraduate physics curricula have included laboratory courses for decades; however, in recent years, studies began to question not only the effectiveness of these labs, but also the ability for these courses to accomplish their designed goals. One of the goals of intermediate laboratory classes is to instill, when possible, expert-like views regarding experimental physics. Intermediate Laboratory (PHYS 2151) utilizes historical processes taken from the early 1900s, intermixed with a variety of conceptual and qualitative exercises, to present students with a holistic approach to modern physics.

Students enrolled in Intermediate Laboratory, in the spring of 2016, were asked to rate how much they agreed with the claim that, “the primary purpose of physics experiments is to confirm known results.” This assessment was conducted both at the beginning and end of the semester through the Colorado Learning Attitudes about Science Survey (e-class). Following the release of the second survey results, it was seen that a significant number of students had come to agree with the statement.

Using methods such as e-class and direct questioning, we seek to explore to what extent students enrolled in this course adopt expert-like views about experimental physics. We hope to encourage the idea that physics is about exploring new ideas, answering unanswered questions, establishing more precise understandings, and in some instances, confirming known results.

---

#### PRIMARY PRESENTER

---

Francis Carmody

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHOR

---

Francis Carmody

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Gary White

---

# EDUCATION

---



---

## GRADUATE SCHOOL OF EDUCATION AND HUMAN DEVELOPMENT

---

### A Critical Analysis of Causes, Consequences, and Solutions to Grade Inflation

The purpose of this study was to generate suggestions for best practices for higher education leaders tackling the pressing issue of grade inflation. Grade inflation is defined in the literature as “a ‘net’ increase in grades resulting from changes in grading practices and standards over time, independent of other contributing factors” (O’Halloran & Gordon, 2014, p.1006). The average college GPA has increased by 0.6 points since 1967, and continues to rise (Felton & Koper, 2005). This study compiles the findings of two literature reviews (including scholarly articles, periodicals, and web sources) regarding the causes, implications, and possible solutions of grade inflation to inform current practice.

The initial literature review yielded four major findings. First, grade inflation devalues grades for evaluators and demotivates students. Second, prescriptive treatments such as grade capping and contextual transcript implementation are ineffective at fighting grade inflation, suggesting that this issue needs to be addressed at the source. Third, faculty vulnerability to external grading pressures as a result of the rise of academic capitalism is a strong risk factor for grade inflation. Fourth, students’ lack of preparation for college level work, as well as their perceptions of grades as deterministic, encourage grade-inflating behaviors.

These findings informed a second literature review to identify and support policy and practical considerations for university leadership to address grade inflation. Based on the above findings, this study aimed to address faculty and student relationships and behaviors as key drivers of grade inflation. Findings suggest that in order to curb grade inflation, university leaders must: a) reestablish faculty autonomy through advocacy, education, and empowerment, b) reset realistic student expectations by clarifying grade standards, and c) provide academically deficient students with the resources necessary to naturally achieve at the college level. Results of this study focus on addressing the sources of grade inflation by reframing achievement in terms of learning.

---

#### PRIMARY PRESENTER

---

Naomi Cholst

---

#### STATUS

---

Student – Graduate

---

#### AUTHOR

---

Naomi Cholst

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Andrew Sonn

---

# EDUCATION

---



---

## GRADUATE SCHOOL OF EDUCATION AND HUMAN DEVELOPMENT

---

### Organizational Development and Social Entrepreneurship in Myanmar

After the crackdown on pro-democracy protests by the military junta in Myanmar in 1988, most universities were either closed or handed over to the military. Since then, many social entrepreneurship initiatives such as community-based organizations (CBEs) have emerged such as hospitals, schools, and agricultural organizations to respond to community needs. From 2012-2016, a certificate program in organizational development was provided to CBE workers in Myanmar but little is known about how this program contributes to organizational change within these CBEs. Thus, the purpose of this exploratory pilot multiple case study was to learn how four leaders of CBEs in Myanmar and along the Thai-Myanmar border use an organizational development certificate program to navigate organizational change processes and serve the purposes of their CBEs and communities. This research utilized a qualitative design with multiple case study research methodology and employed three methods of data collection: semi-structured interviews, document review, and participant observation. The findings of this exploratory pilot study include the importance of credentialism, how CBE leaders uniquely apply the certificate to serve their needs and purposes, and the implementation of internal policies and financial strategies as a result of the program. Implications for research and practice are discussed, and concluding thoughts are provided.

---

#### PRIMARY PRESENTER

---

Oliver Crocco

---

#### STATUS

---

Student – Graduate

---

#### AUTHORS

---

Oliver Crocco

Maria Cseh

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Maria Cseh

---

# EDUCATION

---



---

## GRADUATE SCHOOL OF EDUCATION AND HUMAN DEVELOPMENT

---

### Differences in Caregiver Question Use in Response to Toddlers With and Without Cleft Palate

Questions are an important language recruiting strategy because during early language development, children often respond more frequently to questions than to comments. Children’s responses provide opportunities for caregivers to respond with meaningful semantic and syntactic linguistic input, which is associated with children’s language acquisition. Parental question use can have different forms and be used for different pragmatic functions. During interactions between caregivers and children, questions may encourage child participation in the conversation and continue adult engagement in the conversation. Research has shown that caregivers’ use of questions (rate and form/function of question) varies as a function of children’s age and language skills or disability. For example, research has found that an effective strategy to elicit multi-word replies and to facilitate vocabulary and semantic relations for children with developmental delays is through caregiver question use.

Toddlers with cleft palate are at high risk for speech and language impairments, but are an understudied population. These children have higher rates of unintelligible speech and lower rates of communicating. No research, to date, has examined caregivers’ use of question with toddlers with cleft palate and whether there are observed differences in both the frequency of question asking and the form/function of questions asked between parents of toddlers with cleft palate compared to parents of toddlers without cleft palate. Such differences, if they exist, would have implications for parent-implemented language interventions and would add to the understanding of early language development of young children with cleft palate.

The purpose of this study was to investigate whether caregivers used different strategies in response to toddlers with CP±L compared to toddlers without CP±L. Specifically, the form and function of caregiver question use in response to different types of child comments and requests was examined.

Descriptive analyses of caregiver and child interactions were conducted to examine the differences in caregiver responses to child utterances and caregiver use of questions. The caregiver and child interactions used for this study were video recordings of play-based interactions in a clinical setting. Recorded play sessions were transcribed and analyzed. The participants included 38 children, 19 toddlers with non-syndromic, repaired cleft palate with or without cleft lip and 19 toddlers with typical language development, between 17 and 37 months old and their caregivers. Caregiver response was coded for the percent of utterances that were questions, the type of question used, and the function of the questions asked. Results and implications for practice and future research will be discussed.

---

#### PRIMARY PRESENTER

---

Sarah Einstein

---

#### STATUS

---

Student – Graduate

---

#### CO-PRESENTER

---

Carrie Gillispie

---

#### AUTHORS

---

Sarah Einstein

Carrie Gillispie

Jennifer Frey

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Jennifer Frey

---

# EDUCATION

---



---

## GRADUATE SCHOOL OF EDUCATION AND HUMAN DEVELOPMENT

---

### International University Partnership

Recent years have brought many challenges to the higher education landscape globally: a growing demand, the competition for talent and resources, the push to implement emerging models of higher education while keeping the essence of the traditional university, and globalization. These challenges require universities to embark on international partnerships. It is against this backdrop that the Taibah University (TaibahU) in the Kingdom of Saudi Arabia and the George Washington University (GWU) in the US forged a partnership that includes collaboration in curriculum development, faculty and student exchange, and joint research undertakings. This poster present the inception, key features, nuances and models of the partnership, drawing implications for planning and strategic thinking in university partnerships. An overview of the partnership will be given explaining the collaboration between GWU and TaibahU in the development of a new PhD program in Educational Administration and Leadership that will be offered at TaibahU. The stages of implementation will be explored and both steps that have already been completed and those that will be completed in the future will be included in the poster.

---

#### PRIMARY PRESENTER

---

Angel Ford

---

#### STATUS

---

Staff

---

#### AUTHOR

---

Angel Ford

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Ababayehu Tekleselassie

---

# EDUCATION

---



---

## GRADUATE SCHOOL OF EDUCATION AND HUMAN DEVELOPMENT

---

### Education and Citizenship in Cuba: Opportunities and Challenges for a Global Identity

Educational institutions have played an integral role in citizenship formation, especially in relation to the nation-state. Despite an almost universal acceptance of this form of citizenship formation, globalization has ushered in a new era of education—and citizenship—initiatives. With global flows and movements of people, increased communication, and an interdependence of the world’s economic and political systems, national boundaries and the powers therein have increasingly eroded. It is no surprise then that in the current educational context, there has been a movement away from the nation-state container, to more universal values, competencies, skills and values, reflecting that of our globalized age and a need for global citizenship. Despite much being written on the concepts of global education, little research has been conducted to understand how global citizenship is implemented, especially within a comparative international context. As US-Cuba relations normalize, and the current context of international relations influence the economic, political and social landscape of Cuba, it is important to understand how the current definitions, values, curriculum and pedagogic practices in Cuba help to develop globally competent students and citizens, to better understand and improve the US educational landscape. Thus, this paper provides an analysis of initial findings for how education for global citizenship is defined and implemented within the Cuban education system, specifically at the primary and secondary school level. Against preestablished codes and a framework for global citizenship education (GCE), this study uses qualitative content analysis to explore Cuban educators’ conceptions of GCE, investigates the ways in which Cuban education has opportunity to implement new, global education initiatives, and explores the challenges that may arise in the process in the current context of education in Cuba.

---

#### PRIMARY PRESENTER

---

Jessica Fundalinski

---

#### STATUS

---

Student – Graduate

---

#### AUTHOR

---

Jessica Fundalinski

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Taylor C. Woodman

---

# EDUCATION

---



---

## GRADUATE SCHOOL OF EDUCATION AND HUMAN DEVELOPMENT

---

### Social Identity Exploration: International Students from Mainland China

Drawing upon current literature of Chinese international students as well as existing knowledge of social identity theory, this qualitative research explores the impact of ethnic identity on Chinese international students' identity development in the United States. Based on the data from the interviews with participants self-identified as Chinese international undergraduate students from a large private not-for-profit research university, findings support Phinney's (1995) model of ethnic identity development and has confirmed that the acculturation process for Chinese international students is two-dimensional rather than linear. Taken together, results of the current study add strength to current literature and will inform research on identity development for international students in the United States. Furthermore, policy implications derived from this study will benefit higher education practitioners and increase Chinese international students' overall international exchange experience on campus.

---

#### PRIMARY PRESENTER

---

Janet Gao

---

#### STATUS

---

Student – Graduate

---

#### AUTHOR

---

Janet Gao

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Rick Jakeman

---

# EDUCATION

---



---

## GRADUATE SCHOOL OF EDUCATION AND HUMAN DEVELOPMENT

---

### Social Class and Sense of Belonging: A Quantitative, Intersectional Analysis

The purpose of this study is to understand how social class background plays a role in student experiences on selective campuses. This study centers the experience of low income students and extends the work of Ostrove and Long (2007) but addresses whether race and gender modify the relationship between social class and sense of belonging. Previous research has indicated that race, gender, and socioeconomic status have each, respectively, been demonstrated to have statistically significant relationships to sense of belonging. This research asserts that the interaction effects among these variables could increase the proportion of the variance of the variable sense of belonging that we can explain.

Based in the theory of critical quantitative analysis, the research uses the Student Adaptation to College Questionnaire (Baker & Siryk, 1999) in order to assess sense of belonging. This survey measures academic adjustment, social adjustment and personal adjustment. The data will be analyzed using the hierarchical regression method. The survey will be conducted among undergraduate students at a The George Washington University, a private, urban institution in Washington, D.C. Survey data collection will begin on February 1st, 2017.

---

#### PRIMARY PRESENTER

---

Shonda L. Goward

---

#### STATUS

---

Student – Graduate

---

#### AUTHOR

---

Shonda L. Goward

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Lindsey Malcom-Piqueux

---

# EDUCATION

---



---

## COLLEGE OF PROFESSIONAL STUDIES

---

### Muslim Women and Low-Income Families Learning Basic Computer Skills

The focus of my research has been to evaluate the computer skills of adult learners and explore best practices to teach technology tools to such learners to ensure that they are ready for the changing workforce environment. More specifically, this project has focused on low-income Muslim women in the Northern Virginia area. I partnered with Dar Alhijrah Islamic Center to evaluate the technology needs of the community members and gauged the potential impact of forming a new computer program at the center. Through the initial evaluation, I determined the requirements needed to develop a technology program and form a business model to launch a non-profit community computer lab at the Dar Alhijrah Islamic Center. I attended computer auctions and bought nine computers to be used in the computer lab. I then created a partnership with Computer Core, a non-profit organization that teaches computer skills to low-income families. The organization donated twelve computers to the computer lab and the volunteers from Computer Core will teach the computer courses at the center. In addition, I launched a Go Fund Me campaign to raise additional funds to purchase equipment, and have raised nearly \$4,500 to this point.

My poster presentation will feature the deployment of the business model, fundraising, and a preliminary evaluation of enrolled students in the program. In addition, I will discuss an evaluation that was conducted through Community Based Action Research to provide evidence that low-income Muslim women do not have adequate technology skillset or support of family members to enter into the workforce. Furthermore, the presentation will highlight future research objectives to evaluate the impact of the Computer Core program, and possible pathways to create a sustainable computer lab for the needs of immigrants in the Northern VA area.

---

#### PRIMARY PRESENTER

---

Elyaa Hammad

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHOR

---

Elyaa Hammad

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Olivia Blackmon

---

# EDUCATION

---



---

## ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS

---

### Accessibility and Quality of Education for Refugees: A Case Study of Kyangwali Refugee Settlement

Education is a tool critical for a good future and success in an individual's life. Without education, opportunities are lost. For vulnerable populations, including refugees, education is often not an indivisible right; living in a foreign country fleeing violence and persecution creates a difficult situation for learning. In Uganda, where there are over 600,000 refugees, hundreds of thousands of children are disregarded in the quality of their education. Kyangwali Refugee Settlement is one of ten Ugandan refugee settlements in Hoima district, housing over 40,000 Congolese and Sudanese refugees.

This research combined a practicum with Action Africa Help – Uganda, as well as qualitative research in Kyangwali Refugee Settlement in Hoima District to investigate the current state of educational opportunities for refugee youth. The researcher utilized a variety of different methods in their research. First, the researcher learned the assessment tools in order to properly evaluate education through refugee education. Second, the researcher assessed teachers and school administrations through interviews and focus groups. Next, the researcher conducted surveys with upper primary and secondary school students to understand crosscutting issues. Last, the researcher interviewed secondary school students to comprehend individual challenges.

The objectives of the research were as follows: first, the study broadly examined the education system in Kyangwali and identified pertinent challenges refugee children face in accessing a quality primary education. In conjunction, the quality of education was evaluated using standards of evaluation. Next, post-primary opportunities in the settlement were evaluated to understand the quality of secondary education.

Accessibility of school is an extensive problem for primary-aged children in Kyangwali; schools are usually at least an hour and a half from children's homes and with the overwhelming majority of refugees in Kyangwali being subsistence farmers, many are kept home to dig or plant in the garden. Classrooms are congested or in disrepair, with up to eight children sitting on a bench made for four or five. This study also disclosed refugee-specific issues regarding language, gender, and culture. To conclude, this study addresses avenues of change that AAH-U or UNHCR could utilize in order to increase primary school enrollment and improve the quality of education received.

---

#### PRIMARY PRESENTER

---

Meital Kupfer

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHOR

---

Meital Kupfer

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Charlotte Mafumbo

---

# EDUCATION

---



---

## GRADUATE SCHOOL OF EDUCATION AND HUMAN DEVELOPMENT

---

### What's Next? Adult Outcomes Among Graduates of a School for Students with Physical Disabilities and Health Impairments

The purpose of this study is to develop an understanding of adult outcomes for individuals who attended the *East Coast School*. Founded in the 1960s, the *East Coast School* is a private, specialized school serving students with physical disabilities and significant medical needs, who may otherwise need to receive instruction in their homes or a hospital. The school offers students a traditional educational setting of rigorous academics, opportunities for personal growth, and leadership development.

Research suggests that young adults who received special education services in school are at risk for experiencing poor outcomes in adulthood. In comparison to their peers without disabilities, young adults with disabilities are less likely to participate in postsecondary education, live independently, participate in inclusive social experiences, or be employed (Newman et al., 2011). The state in which the *East Coast School* is located has reported that 37.6% of students with disabilities exiting high school were enrolled in postsecondary education after one year (Office of Special Education Programs, 2015). Anecdotal reports from the *East Coast School*, in contrast, suggest that over 80% of the school's graduates pursue postsecondary education. Cognizant of this contrast, the school was interested in developing a more comprehensive understanding of their graduates' outcomes.

Using a national, longitudinal survey as a model, school professionals and researchers collaborated to develop an online survey that would be meaningful to school alumni and provide useful information to the school and research team. During an initial pilot phase, nearly 40 *East Coast School* graduates responded to the survey. Researchers will analyze pilot data, including participant characteristics and outcomes, using descriptive statistics. Open-ended questions will be coded for common themes. Building on this pilot, a consortium of six schools serving a similar population of students has indicated an interest in sharing this survey with their graduates.

Research findings will contribute to describing the outcomes of former *East Coast School* students. Additionally, insights into barriers and supports impacting these outcomes will contribute to discussions of special education and disability policies and practices, such as special education services in P-12 schools, inclusive opportunities after high school, training programs, college access and persistence, and workforce and labor hiring and employment practices.

---

#### PRIMARY PRESENTER

---

Elisabeth Kutscher

---

#### STATUS

---

Student – Graduate

---

#### AUTHORS

---

Elisabeth Kutscher

Maxine Freund

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Maxine Freund



---

## GRADUATE SCHOOL OF EDUCATION AND HUMAN DEVELOPMENT

---

### Leadership Coaching: A Multiple-Case Study of Urban Public Charter School Principals' Experiences

The education sector faces a shortage of highly skilled leaders in addition to a leadership retention crisis (School Leaders Network, 2014). Leadership coaching, used for decades in the business sector (Joo, 2005), is becoming more commonly practiced in the education sector as a way to support and develop school principals (James-Ward, 2013; Kampa-Kokesch & Anderson, 2001; Kee, Anderson, Dearing, Harris & Shuster, 2010; Lochmiller, 2014; Reeves, 2009; Reiss, 2006; Rhodes, 2012; Thach, 2002; Wise & Jacobo, 2010; Wise & Hammack, 2011). Although research on leadership coaching for traditional public school principals has emerged over the past decade, there is a lack of research on leadership coaching for public charter school principals. Thus, this study extends this body of research beyond traditional public school principals and to the school principals in public charter schools in order to ensure that their perspectives and experiences of leadership coaching may be incorporated into the literature.

This multi-case study seeks to understand the experiences of New York City and Washington, DC public charter school principals who have experienced leadership coaching, a component of leadership development. This study looks at how public charter school principals describe the impact of leadership coaching practices on their leadership development, as well as how they describe their own leader identity construction through the process of coaching. Eight public charter school principals were selected for participation in the study, with data collected through interviews, documents and artifacts shared by the participants.

Data are presented within three main themes: the coaching process, the impact of coaching, and the principal leader identity construction. Interpretation of these findings highlights inconsistency between participants' understanding of leadership coaching and the literature as well as consistency with research on the impact of coaching. Furthermore, through artifact analysis and participant reflection, this research offers evidence that leadership coaching supports the process of leader identity construction, thus extending the literature on leadership coaching for school principals.

---

#### PRIMARY PRESENTER

---

Anne Lackritz

---

#### STATUS

---

Student – Graduate

---

#### AUTHOR

---

Anne Lackritz

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Maria Cseh

---

# EDUCATION

---



---

## GRADUATE SCHOOL OF EDUCATION AND HUMAN DEVELOPMENT

---

### How Economics Affect Education: A Cuban Case Study

This study provides a brief economic history of Cuba from the early 1990s to present day, and explores how the Cuban economy affects its education system and society. Following the collapse of the USSR, Cuba entered an economic crisis, often referred to as the “Special Period.” Despite the financial difficulties, Cuba still prioritized education; however, education and teacher quality were dramatically changed as a result of the economic crisis. Due to the Special Period, Cuba introduced a second currency, the Cuban convertible peso (CUC). The CUC has had a variety of impacts on the Cuban economy, but most noticeably has helped increase tourism and created a paradigm in which a taxi driver can make more money than a teacher. This divergence is likely to be one of the greatest educational challenges in Cuba over the next couple of decades, and could put strain on what is one of the best performing educational systems in Latin America today. Furthermore, this economic history shows that Cuban economic isolationism, due to the United States’ embargo, is still significantly susceptible to global market fluctuations and pressures.

---

#### PRIMARY PRESENTER

---

Beth Milne

---

#### STATUS

---

Student – Graduate

---

#### AUTHOR

---

Beth Milne

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Taylor Woodman

---

# EDUCATION

---



---

## GRADUATE SCHOOL OF EDUCATION AND HUMAN DEVELOPMENT

---

### Emotional Intelligence, Thinking Styles, and Certification Achievement of Senior Human Resource Professionals in the United States

The study examined the relationship between Emotional Intelligence as measured by the Emotional Intelligence Self-Description Inventory (EISDI), Thinking Styles as measured by the Thinking Styles Inventory-Revised II and Certification Achievement of senior human resources professionals in the U.S. as measured by passing the SPHR® examination in the first attempt. The research questions that were investigated were: What is the impact of senior human resources professionals' thinking styles (TS) overall scores and sub scores on certification achievement? What is the impact of senior human resources professionals' emotional intelligence overall scores and sub scores on certification achievement? What is the impact of senior human resources professionals thinking styles overall scores and sub-scores and emotional intelligence overall scores and sub-scores on certification achievement, controlling for selected demographic factors? Logistic regression analysis was conducted for 260 participants of the study and analysis of the results found that, when the variables were considered with the specified controls, in blocks, and in the logistic regression model that best explained the variance in certification achievement with 20.7% Nagelkerke R<sup>2</sup>, only facilitating thinking with emotions predicted passing the SPHR® exam the first time while thinking style Type II (i.e., more operational) predicted failure. Thinking styles Type I and III (i.e., more strategic) and the selected demographic factors (i.e., gender, age range, highest degree achieved, preparation time, human resources experience, and funding source) were inconclusive in their impact on SPHR® certification achievement. The findings show the importance of developing facilitating thinking with emotions and strategic thinking skills for preparation for the SPHR® exam.

---

#### PRIMARY PRESENTER

---

Rubens Pessanha Filho

---

#### STATUS

---

Student – Graduate

---

#### AUTHOR

---

Rubens Pessanha Filho

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Maria Cseh

---

# EDUCATION

---



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Seek First to Understand: Exploring the Implementation of Culturally Relevant Education in the District of Columbia

In the United States, a significant opportunity gap persists between elementary and secondary students holding marginalized identities and their more privileged peers. Overwhelming evidence suggests that this disparity in academic outcomes emerges not from an inherent difference in students' abilities or motivations, but rather from institutional racism within and beyond the public education system. Students of color often do not see their backgrounds represented in the books they read, the discussions in which they participate, or the role models whom they look to in the classroom. Literature suggests that to succeed, all students—regardless of race—must feel validated, supported, and empowered by their academic environments. However, in the District of Columbia, Black students indicate dramatically lower satisfaction with their school climates than their White peers. A growing movement toward culturally relevant education (CRE), a pedagogical paradigm seeking to celebrate diverse identities in the classroom, shows promise at reducing this systemic racial inequity. The focus of this research is the potential for CRE implementation to address and narrow the opportunity gap between Black and White students in Washington, DC. Therefore, the purpose of this study is to explore the current application of culturally relevant educational practices among District of Columbia Public Schools (DCPS) teachers in order to better understand the extent to which DCPS educators address racial disparity within their classrooms. Data gathering will consist of semi-structured qualitative interviews thematically coded to explore how teachers implement CRE techniques, what supports or barriers they experience in executing these methods, and how they respond to racially disparate DCPS student experiences. These insights will inform and strengthen our understanding of DCPS teachers' perceptions of CRE implementation in diverse classrooms in order to inform future research and suggest methods by which the public education system can empower teachers to equitably educate all of their students.

---

#### PRIMARY PRESENTER

---

Victoria Rowe

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHOR

---

Victoria Rowe

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Emily Morrison

---

# EDUCATION

---



---

## GRADUATE SCHOOL OF EDUCATION AND HUMAN DEVELOPMENT

---

### Education in Cuba: What Does Access Look Like?

Though the country is considered a developing nation, Cuba has an exceptional education system. Almost 100% of the population over the age of 15 is literate (CIA, 2016). The government allocates a substantial amount of its national budget to education (Lamrani, 2014). The Cuban education system has been able to be successful because education is centrally planned, free, and public. High levels of investment in education, universal access to primary and secondary school, professional development and teachers, and low-cost instructional material of high quality are some of the characteristics of the Cuban education system (Gasperini, 2000). Though the education system is deemed as exceptional, access to education was/has not always been achievable for Afro-Cubans. The primary purpose of the study was to investigate what access is and what it looks like, and how identity plays a role in access. Focus groups, interviews, and observations were conducted to get a better understanding of access and identity.

---

#### PRIMARY PRESENTER

---

Afua Sarpong

---

#### STATUS

---

Student – Graduate

---

#### AUTHOR

---

Afua Sarpong

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Taylor Woodman

---

# EDUCATION

---



---

**GRADUATE SCHOOL OF EDUCATION AND HUMAN DEVELOPMENT**

---

## Internal and Cultural Struggles Faced by First-Generation Students

First-generation students in a university setting are often grouped together with low-income students regarding their issues, such as struggling to transition into college and financial implications. While this is true, first-generation students are not all low-income and often face struggles outside of transitioning and financial situations. This poster analyzes internal conflicts first-generation students often encounter. These students confront cleft habitus, a disconnect between two world views, such as school and home life. Adjustment to a higher education environment revolves becoming adjusted to an elite lifestyle, different than where most first-generation students grew up. This internal conflict of cleft-habitus may evolve into achievement guilt, where a student feels guilty for educating themselves while their family is unable. Much of these internal conflicts are reflected differently based on cultural backgrounds, thus some students feel these issues more strongly than others. Future research is necessary to help alleviate the struggle first-generation students and their family experience.

---

**PRIMARY PRESENTER**

---

Samantha Schaller

---

**STATUS**

---

Student – Graduate

---

**AUTHOR**

---

Samantha Schaller

---

**RESEARCH MENTOR/  
DEPARTMENT CHAIR**

---

Belinda Huang

---

# EDUCATION

---



---

## GRADUATE SCHOOL OF EDUCATION AND HUMAN DEVELOPMENT

---

### Student Engagement in Primary Schools in Cuba

The United States frequently has problems starting from elementary grades with student motivation to learn. The intrinsic motivation to learn has been associated with higher rates of academic success, specifically relating to lower drop out rates and an overall better memory of material and stronger conceptual learning (Froiland, 2014). Therefore, U.S. educators are committed to creating engaging centers, which integrate technology and multiple intelligences, all to convince students that learning is fun. In Cuba, a classroom at a primary school is very basic by U.S. standards. For example, children sit in rows facing the teacher's desk at the front of the classroom. They copy notes from a chalkboard independently and practice what is being taught. And yet, Cuba has a 0.7% illiteracy rate and 98% of students successfully complete their grade level and move onto the next. To where can they credit this success?

This qualitative study revolves around the educational culture and lifelong learning, which is embraced from a young age in Cuba, and carried out into adult learning. In order to learn more about motivation and engagement in Cuba, a visit to a primary school took place in Holguín, Cuba, along with a week spent interviewing educators at the University of Holguín and University of Havana. Equally important as the interviews and experiences in Cuba is the literature surrounding programs in place regarding Cuba's education system, and literature about how important motivation is for learning. Through this research, the most important aspects in promoting student motivation came down to many government regulations put in place, along with the role of the family, school and community working together for the benefit of their children. This study should be a guide for future educators or education policy makers regarding primary education, especially in less developed countries.

---

#### PRIMARY PRESENTER

---

Emily Silverberg

---

#### STATUS

---

Student – Graduate

---

#### AUTHOR

---

Emily Silverberg

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Taylor Woodman

---

# EDUCATION

---



---

## GRADUATE SCHOOL OF EDUCATION AND HUMAN DEVELOPMENT

---

### Cuban Teacher Evaluation

In Cuba, education is the single most integral piece to the success of their overall society. To assess the quality and qualifications of each teacher, Cuba created a complex, in-depth system to evaluate school staff on a variety of indicators. This research seeks to understand the complexity of the system and compare that to professional and performance-based ideas common in education reform in the United States. This comparative research analyzes the similarities between two large US school districts and Cuba in terms of teacher evaluation.

---

#### PRIMARY PRESENTER

---

Maggie Taylor

---

#### STATUS

---

Student – Graduate

---

#### AUTHOR

---

Maggie Taylor

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Taylor C. Woodman

---

# EDUCATION

---



---

## GRADUATE SCHOOL OF EDUCATION AND HUMAN DEVELOPMENT

---

### Student Success in Cuban Higher Education: A Priority of the Community

#### PURPOSE

Student support services have been taking a better-defined role in higher education in the past decades as a means to ensure student enrollment, retention, and graduation rates. Higher education professionals are constantly questioning what added services can be developed and implemented in order to ensure that students not only have access to college, but are also succeeding. More recently this has grown to focus on how students from marginalized groups can be helped (specifically racial minorities for the purposes of this research). Since Cuba is considered to have a successful educational system, I wanted to know if they had support systems that could be incorporated into our higher education institutions to better help our students of marginalized communities. I am interested in what we can do to continue to diversify and globalize our campus and education system, and Cuba seemed like a country ripe with knowledge that could be helpful to us.

#### RESEARCH METHODOLOGY

In order to determine this, I did research on what services higher education institutions in Cuba provide, and the general role that race plays in education in Latin American countries for comparison. I also reviewed articles published by Cuban writers about life, culture, and society within Cuba to try to better understand the dynamics of the people prior to traveling to Cuba. While in the country, I learned more about the politics and education of Cuba through lectures, seminars, round tables, and informal conversations with Cuban educators and citizens about their lives, degrees, and educational support they received.

#### FINDINGS

The Cuban educational system is very community-focused and driven. Faculty, students, staff, family, neighbors, and everyone within the community is involved in reviewing and agreeing to the education they receive, constituting a community of learners. For this reason, learning is not just contained within the classroom, but is seen in all aspects of daily life. I found myself receiving Cuban historical and political lessons from Cuban educators and taxi drivers alike. This added level of support from the entire community to encourage students to continue their education is a strong factor in ensuring that students feel supported through their educational career.

#### MEANING

In reviewing these findings, I understand that incorporating community support into higher education, alongside student support services, can help motivate students to succeed. Open access is only as successful as the amount of continued support we can offer students. By integrating students into an interested community dedicated to ensuring the success of each student, we provide them with a far-reaching support network beyond the walls of our institutions. If developing a well-educated society becomes the priority of every community, we will be granted the opportunity to truly make education a right for all where not only access is increased, but also retention and degree completion. Students support services are effective and successful as long as all the stakeholders are involved in the process.

#### PRIMARY PRESENTER

Amaris Vázquez Vargas

#### STATUS

Student – Graduate

#### AUTHOR

Amaris Vázquez Vargas

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

Taylor Woodman

---

# EDUCATION

---



---

## GRADUATE SCHOOL OF EDUCATION AND HUMAN DEVELOPMENT

---

### Foreign Language Teacher Education: A Comparative Analysis of New York State and Cuba

As globalization has increased, so have the demands to communicate worldwide and across cultures. Since there are thousands of languages that divide the human race and provide a hurdle to overcome, millions of people learn second, third, or more languages to increase and improve their communication abilities across countries and cultures. Prior research has shown that the “critical period” for developing languages occurs before the age of 12. For this reason, education systems in countries around the globe have included some form of foreign language requirement into their curricula that students must pass for successful completion of their basic education studies. This is true for both the United States and Cuba. In order to achieve this challenge, there is a need for those who can instruct foreign languages in a way that is conducive to student learning and production of language. How are teachers in the United States, particularly in New York State due to its high teacher certification standards, and those in Cuba trained and prepared to teach foreign languages to secondary school-aged students? Data from in-country observations and interviews highlight the whole of the teacher preparation process in Cuba from undergraduate course curriculum to certification exams to teacher placement. The findings of this study will detail the similarities and differences between the programs that will provide recommendations for improvement of both NY and Cuban teacher education programming.

---

#### PRIMARY PRESENTER

---

William Webber

---

#### STATUS

---

Student – Graduate

---

#### AUTHOR

---

William Webber

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Taylor C. Woodman



---

## SCHOOL OF ENGINEERING AND APPLIED SCIENCE

---

### Acoustic Vaporization Threshold of Lipid Coated Perfluoropentane Droplets

Phase shift droplets that can be vaporized in situ by acoustic stimulation offer a number of advantages over microbubbles as contrast agents due to their higher stability and smaller size distribution. They have potential applications in tumor imaging and drug delivery. The acoustic vaporization threshold (ADV) of droplets with perfluoropentane (PFP) core has been investigated extensively via optical and acoustical means. However, there are noticeable discrepancies among reported ADV thresholds between the two methods. In this study, we thoroughly discuss the criteria and the experimental methodology of determining the ADV threshold. In addition, we explain the possible reasons for the discrepancies between the optical and acoustical studies of the droplet vaporization. The ADV threshold was measured as a function of the excitation frequency by examining the scattered signal from PFP droplets (400-3000nm). The threshold increases with frequency-2 MPa at 2.25 MHz, 2.5 MPa at 5 MHz and 3 MPa at 10 MHz. The scattered response from droplets was also compared with the scattered response from a microbubble at the corresponding excitation pressure and frequency. We found the ADV threshold to increase with frequency. The ADV threshold values determined here are in agreement with past values obtained using an optical technique.

---

#### PRIMARY PRESENTER

---

Mitra Aliabouzar

---

#### STATUS

---

Student – Graduate

---

#### AUTHORS

---

Mitra Aliabouzar

Krishna N. Kumar

Kausik Sarkar

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Kausik Sarkar

---

# ENGINEERING

---



---

## SCHOOL OF ENGINEERING AND APPLIED SCIENCE

---

### Out-of-Flatness Plate Tolerances for Steel Tub Highway Bridges

Steel tub (box) girders are widely used for highway bridges. The slender plate components of these structures are subject to local buckling. This compressive limit state is particularly consequential in webs, midspan top flanges, and continuous-over-support bottom flanges during construction. There have been multiple incidents of bridge collapse failures in the past due to thin plate instability. In the United States, there are currently no out-of-flatness tolerances for bottom flanges of steel tub girders in governing codes. This study uses Finite Element Analysis (FEA) to better understand the effect of initial out-of-flatness on girder yield-strength. This extends previous studies to include co-existing imperfections in webs and bottom flanges as well as both 50 ksi and 100 ksi yield steel plate. Code adoption of  $bf/200$  is recommended for the bottom flange out-of-flatness tolerance, where  $bf$  represents the bottom flange width, based on this research and previous studies.

---

#### PRIMARY PRESENTER

---

Mahdi Asadnia

---

#### STATUS

---

Student – Graduate

---

#### AUTHORS

---

Mahdi Asadnia

W. M. Kim Roddis

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

W. M. Kim Roddis



---

## SCHOOL OF ENGINEERING AND APPLIED SCIENCE

---

### Simulations and Measurements of the Thermal Behavior of an Electrochemical Cell

Lattice Enabled (or Low Energy) Nuclear Reactions (LENR) provide a new way to produce clean nuclear energy free of damaging prompt radiation, radioactive waste and greenhouse gases. Electrochemical means are being used to produce LENR by the interactions of protons with nickel. The protons are produced by the electrolysis of water in cells with a nickel cathode. The thermal behavior of such cells due to electrical heating must be understood. It will serve as the basis on top of which LENR are expected. Thermocouples are used to measure temperatures at two points, one in the cell and the other in the nearby air. While invaluable, such limited measurements are insufficient to understand the overall thermal behavior of the cell.

To acquire more detailed information, the electrical and thermal modules of COMSOL are being used to simulate the generation and redistribution of heat in the cells. Included are the geometry, materials, voltages, fields, currents, resistive heating and heat redistribution of the cells as a function of the applied voltages and chemical composition of the electrolytes. Conductive, convective and radiative transfers of heat are all considered. Meshing of the simulations is an important consideration, which determines run times. The simulations are benchmarked by comparison with the measured temperatures.

Results of the simulations provide details far beyond what can be measured. For example, the spatial distributions of temperatures are obtained at any time after initial application of voltages. They will be compared with thermal images from an infrared camera. And, the time histories of the temperatures at any spatial point are available. They are compared with the measured time variations of temperatures in the center of the cells, including the time constant for the temperature rises and the asymptotic temperature increases. The latter are determined when the conductive, convective and radiative power losses are equal to the input electrical power.

The combination of simulations and measurements helps to determine the relative importance of thermal power losses (a) to the air surrounding the cells and (b) through the nickel cathode, platinum anode wires and the aluminum base plate, which holds the cells. Work to date has involved steady state input electrical currents. A future goal will be to simulate and measure the results of pulsed electrical input profiles. The current simulations and measurements provide the baseline for later quantification of LENR power.

---

#### PRIMARY PRESENTER

---

Zachary Awtry

---

#### STATUS

---

Student – Undergraduate

---

#### CO-PRESENTER

---

Emma Gutzmann

---

#### AUTHORS

---

Zachary Awtry

Emma Gutzmann

Jessica Thompson

David Nagel

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

David Nagel



---

## SCHOOL OF ENGINEERING AND APPLIED SCIENCE

---

### Predictive Collaborative Robots via Deep Reinforcement Learning

In recent years, advances in the field of collaborative robotics have enabled people and robots to work in a shared environment. However, the complexity of modeling human-robot interaction and difficulty of automating many tasks has restricted the application range of collaborative robots. This research introduces a model free reinforcement learning-based framework capable of learning to perform new tasks, as well as learning the human behaviors associated with those tasks, enabling a robotic system to work directly with people to complete a shared objective. By utilizing data captured from a camera mounted above the workspace, this framework acts as an adaptive control system that enables a collaborative robot to adjust to changes in its environment in real time.

First, a classification neural network is trained to model the probability distribution of human behaviors associated with a specific task based on data collected on that task being performed. Then, a Deep Q Network is trained in simulation, converging to an optimal decision policy based on the rewards it receives for the outcomes of actions it selects. In contrast to traditional approaches to programming robots, this system “learns” generalizable policies that allow it to adapt to dynamic environments, enabling high levels of performance in scenarios it has never encountered before. This system was implemented on a collaborative assembly task both in simulation and in physical space, in which the objective was to assemble a series of parts in a specific order in collaboration with a person. This resulted in an average efficiency increase 24.8% over the person working alone while maintaining a high standard of safety. This novel approach to addressing human-robot interaction enables collaborative robots to become predictive rather than reactive, resulting in safer and more efficient collaboration.

---

#### PRIMARY PRESENTER

---

Scott Barnes

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHORS

---

Scott Barnes

Adam Wickenheiser

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Adam Wickenheiser



---

## SCHOOL OF ENGINEERING AND APPLIED SCIENCE

---

### Techno-Economics of Large-Scale Solar Farms Implemented in Coastal Southeastern United States

Solar energy generation is becoming increasingly prevalent as a renewable, clean energy resource. It is currently being utilized all over the world in response to both the ever-growing demand for electricity, as well as the desire to reduce the emission of greenhouse gases produced by fossil fuels.

As solar technology develops, the implementation of utility-scale solar plants has become economically feasible. In the summer of 2014, Duke Energy Renewables began construction of a series of solar arrays in rural North Carolina. This development was funded through the collaboration of the George Washington University, American University, and the George Washington University Hospital. This power purchase agreement (PPA) is the first of its kind, and these solar plants will generate and supply electricity to each of the collaborating urban institutions for the next 20 years.

This case study reflects on the particular conditions that made the siting of a solar farm in northeastern North Carolina, on an arm of the PJM electrical grid, a feasible opportunity for large-scale investment by organizations located 230 miles away in Washington, DC.

This study discusses the feasibility of generating and supplying electricity to the grid from North Carolina and the financial benefits of the site at local and regional levels. Through this study, we have developed a model to determine the economic feasibility of implementing utility-scale, photovoltaic solar arrays. This model analyzes the economic potential of the employed land, through historical and current data, and considers land use alternatives under different scenarios.

The effectiveness of the Colonial Eagle One solar farm (Capital Partners Solar Project, Phase One) is compared with other successfully operated photovoltaic solar plants. Personal interviews and site visits were conducted in order to understand the operation of the solar farm and the investment of each contributing party. In addition, discussion of the financial incentives and tax credits which made this site possible provides insight into the importance of future renewable energy policy decisions.

This utility-scale solar project was a success, as all members of the Capital Partners Solar Project, Duke Energy Renewables, and even the leasing landowners in North Carolina are profiting from the endeavor. While the success of this solar energy project was a culmination of particular circumstances, this study provides insight into the future development of utility-scale, sustainable energy investments and concludes that other organizations can benefit from similar investments in clean energy generation projects.

---

#### PRIMARY PRESENTER

---

Nicholas Batista

---

#### STATUS

---

Student – Graduate

---

#### AUTHORS

---

Nicholas Batista

Saniya LeBlanc

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Saniya LeBlanc



---

## SCHOOL OF ENGINEERING AND APPLIED SCIENCE

---

### Computational Geometric System Identification

System identification deals with building a mathematical model of a dynamic system from measured input-output responses. It is critical to obtain a precise mathematical model, as any analysis in control and estimation heavily rely on the ability to describe the dynamic system accurately.

In particular, there are unique challenges in system identification for the attitude dynamics of a rigid body, as they evolve on the compact nonlinear manifold, referred to as the three dimensional special orthogonal group. Traditionally, attitude estimation and identification problems have been studied in terms of Euler-angles or quaternions. It is well known that three-parameter minimal representations, such as Euler angles and Rodriguez parameters suffer from singularities, and therefore, they are not suitable for the identification for the attitude dynamics involving large angle rotations. While quaternions do not exhibit singularities, it is challenging to represent sensitivities or perturbations of attitude trajectories in term of quaternions.

Recently, estimation for the attitude dynamics has been studied directly on the special orthogonal group to completely avoid singularities and complexities associated with Euler angles or quaternions. But, they should be carefully implemented numerically, especially in attitude estimations and optimizations, as the numerical trajectories of rotation matrices may deviate from the special orthogonal group due to computational errors.

The goal of this presentation is to address the aforementioned challenges in system identification of the attitude dynamics with computational geometric optimal controls. The unique contribution is that the identification problem is formulated as an optimization problem on the special orthogonal group with the discrete-time attitude dynamics represented by a Lie group variational integrator. Furthermore, the discrete-time necessary conditions for optimality are constructed on the tangent space of the special orthogonal group intrinsically. As such, the attitude dynamics and their sensitivities are globally defined, and the orthogonal structures of rotation matrices are automatically preserved without relying on any projection or constraint, throughout numerical iterations required to solve the optimality condition. Therefore, the proposed method is particularly useful in system identification of the attitude dynamics that involve nontrivial rotations and large uncertainties. In short, in this study, a general method to overcome identification problem of attitude dynamics are proposed which is ready to apply for estimation of any unknown parameter, while the subsequent developments focus on the identification of the inertia matrix. This is to present the key idea of the proposed approach through a concrete, but nontrivial example.

---

#### PRIMARY PRESENTER

---

Mahdis Bisheban

---

#### STATUS

---

Student – Graduate

---

#### AUTHOR

---

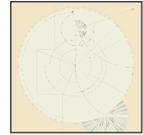
Mahdis Bisheban

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Taeyoung Lee



---

## SCHOOL OF ENGINEERING AND APPLIED SCIENCE

---

### Surface Obstacles in Extremely Pulsatile Flow

Flows past obstacles mounted on flat surfaces have been widely studied due to their ubiquity in nature and engineering. For nearly all of these studies, the freestream flow over the obstacle was steady, i.e. constant velocity unidirectional flow. Unsteady, pulsatile flows occur frequently in biology, geophysics, biomedical engineering, etc. Our study is aimed at extending the comprehensive knowledge base that exists for steady flows to considerably more complex pulsatile flows. Beyond the important practical applications, characterizing the vortex and wake dynamics of flows around surface obstacles embedded in pulsatile flows can provide insights into the underlying physics in all wake and junction flows. In this study, we experimentally investigated the wake of four canonical surface obstacles: hemisphere, cube, and circular cylinders with aspect ratio of 1:1 and 2:1. Phase-averaged PIV and hot-wire anemometry are used to characterize the dynamics of coherent structures in the wake and at the windward junction of the obstacles. Complex physics occur during the deceleration phase of the pulsatile inflow. We propose a framework for understanding these physics based on self-induced vortex propagation, similar to the phenomena exhibited by vortex rings.

---

#### PRIMARY PRESENTER

---

Ian Carr

---

#### STATUS

---

Student – Graduate

---

#### AUTHORS

---

Ian Carr

Michael W. Plesniak

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Michael W. Plesniak

---

# ENGINEERING

---



---

## SCHOOL OF ENGINEERING AND APPLIED SCIENCE

---

### Powder Distribution of Bismuth Telluride for Additive Manufacturing of Thermal Electric Converters

#### OVERVIEW

---

The LeBlanc Lab works to develop energy conversion technologies using advanced materials and manufacturing techniques. The LeBlanc Lab to build an additive manufacturing device that intakes .stl files and outputs Bismuth Telluride thermal eclectic converts with novel geometries.

#### INTRODUCTION

---

Thermoelectric modules convert thermal energy to electrical energy. Exothermic reactions are created intentionally in coal, natural gas and nuclear based electricity generation. However, the stored potential energy of the fuel is not equal to the electrical energy generated due in part to uncaptured thermal energy from the reaction. Active electronic systems are exothermic due to resistance, as are biological process through internal and external processes as the organism exerts itself. Thermoelectric can be applied in all of these environments to convert thermal energy into electricity. However different environments require different and sometimes complex geometries to optimize their efficiency.

#### MOTIVATION

---

When precision of parts is required, traditional & subtractive manufacturing processes are limited to geometries cut along specific planes of the base unit cell of  $\text{Bi}_2\text{Te}_3$  due to its brittle property. Additive manufacturing of  $\text{Bi}_2\text{Te}_3$  allows for the rapid, automated, manufacturing of geometries currently unavailable. Thermoelectrics operate in a solid state but suffer from conversion inefficiencies and limited operating temperatures. Optimization of thermoelectric geometries will increase conversion efficiency.

#### RESEARCH OBJECTIVE

---

In order to build a selective laser melting based additive manufacturing device for  $\text{Bi}_2\text{Te}_3$  the lab must answer the preliminary questions. Which Bismuth Telluride powder morphology and size allows for the greatest followability and even distribution. How to distribution 100 micrometer thick layers of Bismuth Telluride powder in a repeatable. How to selectively laser melt a 100 $\mu\text{m}$  thick layer of Bismuth Telluride powder to a previous layer utilizing a Ytterbium fiber laser.

---

#### PRIMARY PRESENTER

---

Joseph Crandall

---

#### STATUS

---

Student – Undergraduate

---

#### CO-PRESENTER

---

Shakti Gurikar

---

#### AUTHORS

---

Joseph Crandall

Shakti Gurikar

Ahmed El Desouky

Michael Carter

Saniya LeBlanc

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Saniya LeBlanc

---

# ENGINEERING

---



---

## SCHOOL OF ENGINEERING AND APPLIED SCIENCE

---

### How to Catch a Black Swan: Measuring the Benefits of the Premortem Technique for Risk Identification

Projects face the challenge of increasing complexity and uncertainty leading to more black swans (hard-to-predict, potentially catastrophic risks) in our future. Within the two schools of risk (objective and subjective) we theorize the latter is the key to early identification of the black swan. Creativity-based risk identification techniques are not bound by the historical data and precedence but teams must overcome deliberate ignorance for meaningful collaboration. This study compares two creativity-based risk identification techniques—brainstorming and premortem. The premortem is the theoretical opposite of a postmortem. In a postmortem the investigator determines the cause of death after the patient has died. The premortem calls for a team to imagine the project has failed and deduce causes for the failure. The team then proposes changes to the project plan to address causes of the failure. We conclude that teams using the premortem technique identified better quality risks, more quality changes to the plan and identified more black swan risks than their brainstorming counterparts.

---

#### PRIMARY PRESENTER

---

David Gallop

---

#### STATUS

---

Postdoctoral Student

---

#### AUTHORS

---

David Gallop

Christopher Willy

John Bischoff

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Christopher Willy



---

## SCHOOL OF ENGINEERING AND APPLIED SCIENCE

---

### Robotic Autonomous Exploration via Exact Occupancy Grid Mapping

Autonomous exploration is gaining popularity in the robotics community as an effective tool to safely govern robotic motion. Unlike common methods where humans provide trajectories for robots to follow, autonomous exploration exploits aspects of the surrounding environment and sensor properties to determine robotic actions. This research focusses on choosing robotic motions that maximize knowledge of the surrounding space to generate a map as quickly as possible.

First, we determined an exact solution to a probabilistic map that evaluates the occupancy of the environment surrounding a robot, known as occupancy grid mapping. This method serves to generate maps with greater certainty than other occupancy grid mapping techniques, which typically rely on heuristic approximations or learned solutions. The proposed method is computationally-efficient, and is applied in real-time with experiments on mobile robots.

Second, we extend theoretical contributions from occupancy grid mapping to predict future knowledge about the map. Using Shannon's entropy, which serves as a measure of map uncertainty, robotic actions are chosen based on how much the future measurements are expected to increase the map information, or equivalently decrease uncertainty. The proposed mapping and exploration approaches are demonstrated with numerical examples and experiments.

---

#### PRIMARY PRESENTER

---

Evan Kaufman

---

#### STATUS

---

Student – Graduate

---

#### AUTHORS

---

Evan Kaufman

Taeyoung Lee

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Taeyoung Lee

---

# ENGINEERING

---



---

## SCHOOL OF ENGINEERING AND APPLIED SCIENCE

---

### Optimization of Thermal Sintering Parameters of Silver Nanoparticle Ink

Sintering is a post processing step performed after inkjet printing that allows for the agglomeration of particles by removing excess solvent. The production of any digitally printed electronic device must go through sintering first because it is vital for the formation of conductive electrical tracks. Thus optimizing sintering parameters such as time and temperature is crucial to conduction. Silver nanoparticles with a 7 nm diameter will be used in the ink for this experiment. Through the use of a four-point electrical probing station, an optical microscope, and a profilometer, there will be a better understanding for which parameters operate at a minimal resistivity for these particular designs.

---

#### PRIMARY PRESENTER

---

Natalie Rozman

---

#### STATUS

---

Student – Undergraduate

---

#### CO-PRESENTER

---

Annette Browne

---

#### AUTHORS

---

Konstantinos Koumousidis

Annette Browne

Natalie Rozman

Saniya LeBlanc

Michael Orrill

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Saniya LeBlanc



---

**SCHOOL OF ENGINEERING AND APPLIED SCIENCE**

---

## Spacecraft Trajectory Design Near Asteroid 4769 Castalia

In this paper, we extend the design method previously developed in the three-body problem to motion about asteroids. The authors present a systematic method of generating optimal transfer orbits about asteroids. Our systematic approach avoids the difficulties in selecting an appropriate initial guess for optimization. We instead utilize the concept of the reachability set to enable a simple methodology of selecting initial conditions to achieve general orbital transfers. This method allows us to avoid the difficulties inherent in choosing valid initial conditions for the computation of optimal transfer trajectories. We develop the optimal control formulation and apply this method to an example transfer about asteroid 4769 Castalia.

---

**PRIMARY PRESENTER**

---

Shankar Kulumani

---

**STATUS**

---

Student – Graduate

---

**AUTHOR**

---

Shankar Kulumani

---

**RESEARCH MENTOR/  
DEPARTMENT CHAIR**

---

Taeyoung Lee



---

## SCHOOL OF ENGINEERING AND APPLIED SCIENCE

---

### Study of Acoustic Droplet Vaporization Using Classical Nucleation Theory

Lipid coated perfluorocarbon (PFC) nanodroplets can be vaporized by an external ultrasound pulse to generate bubbles in situ for tumor imaging and drug delivery. They have potential applications in tumor imaging and drug delivery. Here we employ classical nucleation theory (CNT) to investigate the acoustical droplet vaporization (ADV), specifically the threshold value of the peak negative pressure required for ADV. The theoretical analysis predicts that the ADV threshold increases with increasing surface tension of the droplet core and frequency of excitation, while it decreases with increasing temperature and droplet size. The predictions are in qualitative agreement with experimental observations. We also estimate and discuss energy required to form critical cluster to argue that nucleation occurs inside the droplet, as was also observed by high-speed camera.

---

#### PRIMARY PRESENTER

---

Krishna Kumar

---

#### STATUS

---

Student – Graduate

---

#### AUTHORS

---

Krishna Kumar

Mitra Aliabouzar

Kausik Sarkar

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Kausik Sarkar



---

## SCHOOL OF ENGINEERING AND APPLIED SCIENCE

---

### Synergistic Effect of Cold Atmospheric Plasma and Drug Loaded Core-Shell Nanoparticles on Adult Human Mesenchymal Stem Cell Chondrogenesis

Progress degeneration of articular cartilage or osteoarthritis of knee is serious clinical problem affecting patient's quality of life. In recent years, artificially engineered cartilage scaffolds have been widely studied as a promising method to stimulate cartilage regeneration. In this study, we developed a novel biomimetic cartilage scaffold by integrating cold atmospheric plasma (CAP) with sustained bioactive factor delivery nanoparticles. Specifically, CAP was applied to 3D printed hydrogel scaffold embedded with drug-loaded nanoparticles. Our results indicated that scaffolds with CAP treatment improve hydrophilicity as well as surface nanoroughness thus facilitating cell adhesion. More importantly, we showed that CAP treatment and nanoparticles can synergistically enhance stem cell growth compared to bare scaffolds. The results in this study demonstrate the potential of integrating CAP and drug-loaded nanoparticles into 3D printed scaffold for promoting cartilage repair.

---

#### PRIMARY PRESENTER

---

Se-Jun Lee

---

#### STATUS

---

Student – Graduate

---

#### AUTHORS

---

Se-Jun Lee

Dayun Yan

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Lijie Grace Zhang



---

## SCHOOL OF ENGINEERING AND APPLIED SCIENCE

---

### The Role of Viscosity in Anaerobic Digestion

#### INTRODUCTION

---

Hydrolysis is widely considered to be the rate-limiting step in anaerobic digestion. In most cases, one considers the hydrolysis rates in the anaerobic digesters to perform at the zero order and thus the maximum hydrolysis rate parameter to determine the overall performance. In this paper this assumption is addressed by investigating the role of viscosity in diffusion and in determining the apparent affinity constants for hydrolysis rates within anaerobic digesters. In activated sludge systems, the apparent half-saturation constants,  $K_s$ , have been shown to impact competition between microorganisms and determine the capacity of the systems. Additionally, the apparent  $K_s$  has been shown to be driven by diffusion rather than by the intrinsic affinity constants. Diffusion increases the value of the apparent  $K_s$  by about 10-fold compared to the intrinsic kinetic parameters of single cells, leaving diffusion as the process limitation that could also play a role in anaerobic digestion. The variables that impact diffusion are particle size, substrate-microbe distance, and diffusivity, with diffusivity being affected by viscosity. Viscosity of digester solids typically exhibits shear-thinning behavior and is impacted by several factors, which may also impact other variables affecting diffusion.

The main goal of this study was to investigate the factors influencing the viscosity of digestate sludge and its effect on hydrolysis rates.

#### RESULTS & DISCUSSION

---

The results of the batch tests performed demonstrated two important outcomes. The first is that the effective diffusivity of the sludge flocs is impacted by the diffusivity of a boundary layer to the floc and by the diffusivity of the sludge within the floc itself. By varying the bulk viscosity and seeing little change in hydrolysis rate, it was determined that the boundary layer diffusivity does not contribute significantly to the effective diffusivity of the sludge. This will direct future research towards looking at the sludge within the floc itself to identify diffusion limitations.

The results also indicate that it may be possible to increase the solids loading on a full-scale anaerobic digester by roughly double its base amount without seeing any detrimental effects to its efficiency, as long as the mixing rate is high enough.

---

#### PRIMARY PRESENTER

---

Elizabeth Manning

#### STATUS

---

Student – Graduate

#### AUTHORS

---

Elizabeth Manning

Rumana Riffat

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Rumana Riffat



---

## SCHOOL OF ENGINEERING AND APPLIED SCIENCE

---

### Big Data Approach to Electron Microscopy Acquisition and Analysis of Neuronal Tissue: Utility in Analysis of Neuronal and Synaptic Alterations in a Mouse Model of 22q11 deletion Syndrome

Although electron microscopy is the ultimate approach for cell organelles resolution, this approach has been suffering several limitations, preventing it from gaining popularity in neuroscience. More specifically, identifying pathological processes in the neurons require careful analysis at the level of single cellular organelles (such as synaptic vesicles, mitochondria or microtubules). High magnification is required to resolve neuronal organelles and individual synapses (i.e., 50-80K), however such an approach limits the field of view preventing the investigators from gaining tissue context and relating the changes to the changes in the neuronal tissue. Moreover, neuroscientists need to focus their data sampling into very distinct and specific tissue areas that are linked to a very specific functional domain.

A novel approach was applied using scanning electron microscopy and block-face imaging from the area of the nucleus of the hypoglossal nerve. The objective is to compare the neuronal architecture and cellular alterations that occur in mouse models of the inherent human disease known as DiGeorge Syndrome. Since the swallowing and feeding is frequently compromised in the patients carrying this disease, the hypothesis is that nerve XII neurons are affected by the cellular alterations in a way that prevents them to perform their function. Therefore, the nuclei of the XII cranial nerve were the main focus, because it contains the neurons innervating the tongue.

To accomplish the objective, an approach was designed for data acquisition and analysis that allowed sampling of the entire area of the XII nerve nuclei at 2nm pixel size. This approach allows several strategies to be applied for data collection and analysis that were impossible with traditional electron microscopy methods.

---

#### PRIMARY PRESENTER

---

Liz Matsiyevskiy

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHORS

---

Liz Matsiyevskiy

Anastas Popratiloff

Christine Brantner

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Anastas Popratiloff



---

## SCHOOL OF ENGINEERING AND APPLIED SCIENCE

---

### Perforation of Cell Membranes Using Contrast Agent Microbubbles in the Presence of Ultrasound

Ultrasound waves are pressure waves capable of transporting energy into the body as they are absorbed relatively little by tissues. Their non-invasive, safe and painless transmission through the skin makes them suitable for use in drug delivery and gene therapy applications. Ultrasound in the presence of microbubbles facilitates transportation of drugs. These FDA approved encapsulated microbubbles (contrast agents) were initially developed for enhancing the contrast of ultrasound image. Contrast agents can carry and transport drugs or genes to the desired site through injection inside the bloodstream. They consist of a gas core encapsulated by a layer of proteins or lipids to stabilize them against dissolution. Ultrasound wave excites the microbubbles making them implode (collapse) resulting in the release of drug/gene into the desired tissue. In addition to the role of microbubble as a drug carrier, we aim to show that the collapse of microbubble forms or even increases the size of the small pores in the cell membrane. This can allow the transfer of DNA/RNA into the cell for gene therapy. It can also help to facilitate the uptake of drugs and large molecules into the cells. It can even help delivering drugs to cells with tight junctions by increasing the permeability of the cells.

In the presence of high ultrasound waves, contrast agents (encapsulated microbubbles) collapse within a few microseconds which makes it very difficult to observe the details of the process experimentally. Therefore, in this research, we are studying their behavior numerically. Boundary element method has been applied for the mathematical modeling of the flow around the contrast agent. It is a grid-free method and has been widely used in bubble dynamics.

The encapsulation of the microbubble can be assumed as an interface with an infinitesimal thickness. There are several models to simulate the interface. In this study, the encapsulation is modelled using a strain softening model developed by our group.

We have shown that the contrast agent forms non-symmetrical microjet at the last stage of the collapse phase. The microjet and the adjacent surrounding fluid move toward the cell membrane with a very high velocity (velocity reaches around 300 m/s in our calculations). This high velocity fluid impinges the membrane and spreads radially along it. This will generate high velocity gradient on the tissue, and therefore it will generate shear stress (which have been calculated numerically) resulting in the rupture and perforation of cell membrane.

---

#### PRIMARY PRESENTER

---

Nima Mobadersany

---

#### STATUS

---

Student – Graduate

---

#### AUTHORS

---

Nima Mobadersany

Kausik Sarkar

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Kausik Sarkar



---

## SCHOOL OF ENGINEERING AND APPLIED SCIENCE

---

### Effects of Contact Configuration and Perimeter Recombination on Optimal Cell Size for High Concentration Photovoltaics

The effects of lateral current flow at the top surface of a solar cell under high light concentration have been previously studied, but typically do not include the limitation of electron-hole recombination along the edge of the device for very small cell sizes. In this study, simulations were performed with LT-SPICE™ to evaluate the limiting effects of cell size, perimeter recombination, and sheet resistance on the performance of a solar cell under 500 sun light concentration with different contact configurations. A circuit model was generated using parameters extracted from a 3 junction InGaP/GaAs/InGaAsN device. The results of the simulation were then used to determine the optimal cell size for a gridless cell and the conditions under which a gridless cell is more efficient than a cell with grid fingers. We found that the inclusion of perimeter recombination current imposes a minimum optimal cell size that yields the highest efficiency, but the highest efficiencies are still generally achieved by a small, gridless cell.

---

#### PRIMARY PRESENTER

---

James Moore

---

#### STATUS

---

Postdoctoral Student

---

#### AUTHORS

---

James Moore

Matthew Lumb

Ken Schmieder

David Nagel

Robert Walters

Brent Fisher

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Dave Nagel



---

## SCHOOL OF ENGINEERING AND APPLIED SCIENCE

---

### Integrated All Optical Fast Fourier Transform (OFFT) On Chip with Heating Tunability–Design and Simulation Analysis

The demand for faster computation is rapidly increasing. New services such as cloud computing and optical co-processors require high capacity optical channels that can perform mathematical functions in parallel since the electrical counterparts are limited by energy, and speed. Many have approached this problem by means of different FFT algorithms, however this is not a fully optimized approach since it lacks a sensitivity analysis on the system level in terms of footprint and component. By integrating the OFFT on chip the footprint and energy of such operations is minimized and the data rate per operation is maximized. Using a practical and simplified scheme to perform the fast Fourier transform in the optical domain is practiced since it can perform at speeds far beyond the limits of electronic digital processing. The design of the optical fast Fourier transform, based on cascaded delay interferometers consisting of optical couplers and phase shifters mainly, is implemented and fabricated on a Silicon On Insulator (SOI) chip. To further have control over the system (i.e. phase, time delay), metallic pads have been placed on the arms of the delay interferometers at all of the stages. This implementation is novel as it is implemented on an SOI chip with a heater for overall control of the structure.

The optical FFT chip consists of an integrated passive optical network with several stages, each of which contains appropriate temporal delays and phase shifts with respect to the system frequency (i.e. 10 GHz). FFT is vastly used as the core process for optical orthogonal frequency division multiplexing (OFDM) transmission, because of its demonstrably favorable high speed and long-haul data transmission including its high spectral efficiency. Previous research studies in the area of Optical Fast Fourier transform (OFFT) indicate that such technique can be performed at speeds far beyond the limits of electronic digital processing with negligible energy consumption. However a fully integration on chip of this design has not been implemented and optimized yet.

Many of the signal processing applications depend on electronic devices which will present a bottleneck to further provide higher capacity and lower cost implementations. The maximum transmission capacity is limited by the speed and the power consumption. These constraints can be bypassed by implementation of all optical devices. Simplified algorithm for OFFT has advantages such as simplification, higher speed, and less energy consumption which is implemented on our integration on chip design.

---

#### PRIMARY PRESENTER

---

Hani Nejadriahi

---

#### STATUS

---

Student – Graduate

---

#### AUTHORS

---

Hani Nejadriahi

Volker Sorger

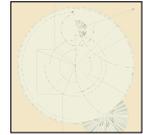
David Hillerkuss

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Volker Sorger



---

## SCHOOL OF ENGINEERING AND APPLIED SCIENCE

---

### Four Dimensional Printing of Gradient Scaffolds for Cartilage Tissue Engineering

Tissue engineering holds great promise for developing methods of repairing damaged tissue. Cells can be harvested from the patient, seeded and grown upon a three dimensional (3D) scaffold *in vitro*, and transplanted back into the patient after desired cellular differentiation. The challenge with such scaffolds at joint surfaces is the diverse nature of the extracellular composition as well as the inherent poor regenerative capacity of native cartilage. The time/temperature dependent responses of polymers with 4D potential also make them ideal candidates for minimally invasive cartilage repair procedures in a clinical setting.

The objective of this study is to create a novel 4D printed scaffold with biomimetic gradient architecture for improved integration and regeneration of articular cartilage. This research uniquely hypothesizes that a porous, gradient, 4D scaffold, with bioactive factor integration will have the ability to spatially recapitulate all phases and orientations of cartilage present at the surface of articulating joints. Scaffolds were coated with polydopamine (PD), bovine serum albumin (BSA), and transforming growth factor beta-1 (TGF- $\beta$ 1) to evaluate their benefits throughout hMSC adhesion, proliferation, and differentiation studies. Stem cell performance improved amongst the PD and PD+BSA+TGF- $\beta$ 1 samples over time with the PD+BSA+TGF- $\beta$ 1 sample significantly outperforming all other samples.

The smart, PCL-based, porous scaffold was also evaluated for shape-changing behavior. The scaffolds were deformed at room temperature and held, in the deformed state, for 10 minutes at 0 °C. The deforming force was then removed and the deformed body was held at 0 °C for an additional 10 minutes. The deformed scaffold was able to recover its pre-deformed state upon immersion in a 37 °C water bath. The ability to control the recovery process at a temperature range similar to the human body shows great promise for future implementation of smart, PCL-based polymers in minimally invasive cartilage reconstruction procedures.

Improved biological performance was evident on porous, 4D-printed, PCL-based scaffolds coated with chondrogenic growth factors when compared to bare scaffolds. Novel aspects of the current study include a more in-depth evaluation of an innovative, smart, PCL-based polymer as a viable material for encouraging hMSC function and promoting chondrogenic differentiation.

---

#### PRIMARY PRESENTER

---

Margaret Nowicki

---

#### STATUS

---

Student – Graduate

---

#### AUTHORS

---

Margaret Nowicki

Michael Plesniak

Lijie Grace Zhang

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Lijie Grace Zhang



---

## SCHOOL OF ENGINEERING AND APPLIED SCIENCE

---

### Synthesis of Inkjet-Printable Solutions with Carbon Nanospheres

Inkjet printing is a promising manufacturing technique for flexible electronics but is limited by the synthesis of printable inks, compatibility of inks with flexible substrates, and the electrical performance of printed materials. An ideal printable electronic ink should be chemically stable, inexpensive, and form highly electrically conductive traces with excellent adherence and stability after solvent evaporation with minimal post-processing. Functional materials should form stable colloidal dispersions with environmentally benign (water, alcohols, etc.) solvents for reliable inks. The most commonly printed electronic materials are silver nanoparticles due to their potentially high electrical conductivity. However, silver is expensive and nanoparticle films require post-processing to recover high conductance. The post-processing step restricts substrate material selection and throughput.

A new class of materials, Hollow carbon nanospheres (HCNS) are promising for use in electronic ink formulations. HCNS are created from a byproduct of a biofuel production process that uses charred cellulose, an agricultural waste product. They are therefore inexpensive and their production reduces the cost of biofuels and serves as a carbon sink, created from fast growing plants such as switchgrass, which requires no tending and thrives on marginal, arid land.

HCNSs are chemically stable and have high electrical conductivity. Their diameter can be controlled through synthesis conditions and can easily be dispersed into alcohols, water, and other solvents to form stable colloids. Chemical modification to improve adhesion or add functionality is also possible with conventional synthesis methods. The HCNS therefore appear to be an ideal material for electronic ink.

Here we synthesize an inkjet printable ink with hollow carbon nanospheres (HCNSs) consisting of concentric graphene spheres. The HCNSs are electrostatically stabilized against agglomeration by washing them in sodium hydroxide. They are then dried and dispersed into ethylene glycol via ultrasonification. Ink properties relevant for inkjet printing—viscosity, and particle size distribution—are characterized. Initial printing trials are successful and printed and particle distribution in printed deposits are investigated by optical and electron microscopy. Printed and dried lines of ink show sparsely connected carbon material. At least 10 layers are needed to achieve adequate material connectivity for electrical characterization. For this reason the concentration of the ink will need to be increased in future iterations. Printing parameters including droplet spacing and drying temperature need to be optimized to achieve narrow, straight lines of carbon material devoid of the “coffee ring effect” whereby most solute is deposited at the periphery and center of the liquid deposit.

---

#### PRIMARY PRESENTER

---

Michael Orrill

---

#### STATUS

---

Student – Graduate

---

#### AUTHORS

---

Michael Orrill

Dustin Abele

Nathan Banek

Michael Wagner

Saniya LeBlanc

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Saniya LeBlanc



---

## SCHOOL OF ENGINEERING AND APPLIED SCIENCE

---

### Effects of Ultrasound in Presence of Microbubbles for Cartilage and Bone Tissue Regeneration in 3D Printed Scaffolds

Gas-filled microbubbles encapsulated with lipids and other surfactants are highly responsive to ultrasound, which has led to their effective role as ultrasound contrast agents (UCA). In this study, for the first time, we used lipid-coated microbubbles (MB) and lipid and nano-hydroxyapatite (n-HA) coated MB prepared in-house to better harness the beneficial effects of ultrasound stimulation on proliferation and chondrogenic and osteogenic differentiation of human mesenchymal stem cells (MSCs) within novel 3D printed poly (ethylene glycol) diacrylate (PEG-DA) hydrogel scaffolds with and without embedded n-HA. A significant increase in cell number ( $p < 0.001$ ) was observed with low intensity pulsed ultrasound (LIPUS) treatment in the presence of 0.5 % (v/v) MB and lipid and n-HA coated MB after 1, 3 and 5 days of culture in scaffolds with and without n-HA. MSC proliferation increased by 20% with LIPUS, 37% with LIPUS and MB, and 43% with LIPUS and lipid and n-HA coated MB for one day studies. MSC proliferation was also enhanced up to 40% after 5 days of culture in presence of MB and LIPUS while this value was only 18% when excited with LIPUS alone in scaffolds not embedded with n-HA. Our 3-week chondrogenic differentiation results demonstrated that combining LIPUS with MB significantly enhanced both Glycosaminoglycan (GAG) and type II collagen production. Therefore, integrating LIPUS and MB appears to be a promising strategy for enhanced MSC growth and chondrogenic and osteogenic differentiation for potential tissue engineering and regeneration therapies.

---

#### PRIMARY PRESENTER

---

Jenna Osborn

---

#### STATUS

---

Student – Graduate

---

#### AUTHORS

---

Jenna Osborn

Mitra Aliabouzar

Lijie Grace Zhang

Kausik Sarkar

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Kausik Sarkar



---

## SCHOOL OF ENGINEERING AND APPLIED SCIENCE

---

### Flow Characteristics and Functionality of Porous Gill Rakers Used in Silver Carp Filter Feeding

This study focuses on the method of food filtration that the silver carp uses when feeding. The gill raker (GR) is the primary component of many fishes' filtering feeding anatomy, and the geometry of the silver carp's GR is completely unique to its species. While other similar fish species (such as the bighead carp) may have comb-like GRs for filtration, the silver carp possesses sponge-like membranes on its GRs that are able to filter particles as small as 4 microns in diameter. It is hypothesized that given its effectiveness of filtration, along with microscopy and dissection work already completed by the GWU Department of Biological Sciences, the silver carp's GRs do not clog with use over time. The highly-effective filtering efficiency of the silver carp and its innate anti-clogging capacity present tremendous potential for industrial application. This technology could be translated over a wide range of engineering applications from waste water treatment to filtration in the food industry.

It appears that permeation through the silver carp gill raker membranes is likely driven by an active pumping mechanism rather than a passive system. Potentially, the pumping mechanism is performed by a series of muscles in the roof of the silver carp's mouth, known as the palatal folds. To further develop an understanding of this filtration system, dye visualization experiments were performed on the severed heads of several fish species that are known filter feeders, including the silver carp. Furthermore, forced flow experiments were conducted across silver carp GR samples to evaluate a relationship between membrane permeability and flow rate. Rheology trials were run to understand the fluid properties of the mucus layer coating silver carp GRs and their potential role in capturing food particles. A laboratory-scale pumping mechanism has been designed and fabricated as a realistic model of the silver carp filtering system. Further flow visualization and hydrodynamic measurements will be performed to fully understand these unique filtration dynamics.

---

#### PRIMARY PRESENTER

---

David Palumbo

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHORS

---

David Palumbo

Karly Cohen

Kartik V. Bulusu

L. Patricia Hernandez

Megan Leftwich

Michael W. Plesniak

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Michael W. Plesniak



---

## SCHOOL OF ENGINEERING AND APPLIED SCIENCE

---

### A Robotic Platform to Investigate the Fluid Dynamics of Sea Lion Swimming

California Sea Lions are very agile swimmers and unlike many marine animals, they use their fore flipper rather than their hind flipper undulations to generate high thrust values. To date, there exist limited amount of qualitative studies for sea lions swimming that show the flippers are used for thrust, stability, and control during swimming motions. Quantitative studies mainly measured drag used for cost of transport, and analyzed banked turn performance. Recently, the kinematics of a California sea lion flipper during the thrust phase was extracted using video tracking in two dimensions. This work extends the tracking ability to three dimensions using a non-invasive Direct Linear Transformation (DLT) technique employed on non-research sea lions at the Smithsonian National Zoological Park. The flippers are therefore marker-less and tracking is carried out manually in post processing after capturing complete dorsal-ventral flipper motions.

The fluid flow and forces generated by a sea lion clap is also being explored.

Recently, a sea lion flipper from a deceased subject was externally scanned in high detail for fluid dynamics research. The flipper's geometry is being used in this work to design and build an articulate flipper model that is approximately 60% of the full size span. The model is currently actuated by one servo motor and has been used for dye visualization experiments in a water flume. A new mechanism is being constructed to more completely mimic a sea lion flipper clap motion based on the previously extracted kinematics from above. The model will incorporate three joints, simulating the movements of the sea lion's elbow, wrist, and knuckles. The flipper tip speed is being designed to match typical Reynolds numbers for the full-scale flipper for an acceleration from rest maneuver. The model will be tested in the same water flume to obtain the forces during the thrust production phase of the flipper motion.

---

#### PRIMARY PRESENTER

---

Rahi Patel

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHORS

---

Rahi Patel

Aditya Kulkarni

Chen Friedman

Megan Leftwich

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Megan Leftwich

---

# ENGINEERING

---



---

## SCHOOL OF ENGINEERING AND APPLIED SCIENCE

---

### Raspberry Pi Cluster Load Balancer to Conserve Electricity in Server Farms

It is estimated that the U.S. consumed a total of 70 billion kWh in 2014, accounting for about 1.8 percent of total U.S. electricity consumption. This energy use is on the rise with a significant portion of it being wasted. In order to meet expanding computing demands, lower environmental impact, and save on operation costs, better efficiency practices must be adopted soon. Through using smarter load balancing techniques these goals can be reached.

---

#### PRIMARY PRESENTER

---

Joseph D. Schiarizzi

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHOR

---

Joseph D. Schiarizzi

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Gabriel Parmer



---

## SCHOOL OF ENGINEERING AND APPLIED SCIENCE

---

### Hybrid Photonic Plasmonic Interconnect (HyPPI): Tracing Moore's Law in a CLEAR Way

Fundamental physics, process control, and economic pressure demand ongoing changes and adaptations for technology development of the semiconductor industry. The continuing demands for increased compute efficiency and communication bandwidth have led to the development of novel interconnect technologies, such as photonic, plasmonic, and hybrid photonic plasmonic interconnects (HyPPIs). As the guiding rule of the semiconductor industry, Moore's law, has shifted its driving forces more than once before; from counting transistors that the industry pivoted to transistor size- and cost-scaling due to the limits of on-chip size and complexity. While some efforts such as the Moore's law and Makimoto's wave have been made to capture link performance more accurately, they eventually deviate from the observed development pace. Here, we propose a holistic figure of merit (FOM) termed Capability-to-Latency-Energy-Amount-Resistance (CLEAR) to adequately compare these recent technology paradigms which not only includes the components count but also considers the communication delay, energy efficiency, on-chip scaling and also the economic cost of a interconnect. Such a FOM has to be holistic as to encompass performance parameters of a multitude of technology options while keeping track of the respective costs. Moreover, it accurately and equitably postdicts the technology developments since the 1940's until today, and predicts photonics as a logical extension to keep up the 2x/year pace of information-handling machines. At last, since this FOM is derived bottom-up, we demonstrate remarkable adaptability to applications ranging from device- and link-level to network- and system-level. Applying CLEAR to benchmark the performance under these levels against fundamental physical compute and communication limits shows that HyPPI is competitive even for fractions of the die-size, thus making a case for on-chip optical interconnects and network applications. Furthermore, based on the link-level CLEAR, a multi-technology network-on-chip (NoC) is able to be dynamically controlled and optimized for different applications. Founded on fundamental physical principles, it can be regarded as the next Moore's law for the coming decades in data processing and computing in order to reveal the actual technology evolution and multi-technology NoC integrated design.

---

#### PRIMARY PRESENTER

---

Shuai Sun

---

#### STATUS

---

Student – Graduate

---

#### AUTHORS

---

Sun Shuai

Vikram Narayana

Tarek El-Ghazawi

Volker J. Sorger

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Volker J. Sorger



## SCHOOL OF ENGINEERING AND APPLIED SCIENCE

### Achieving Sustainable Water Purification: Tailored Graphitic Carbon Nitride for the Removal of Persistent Organic Contaminants

Solar-energy-enabled photocatalysis is a sustainable technology to destruct persistent environmental pollutants via the attack of photogenerated reactive oxygen species (ROS, e.g.,  $\bullet\text{OH}$ ,  $\text{O}_2\text{-}\bullet$ / $\text{HO}_2\bullet$ ,  $\text{H}_2\text{O}_2$ ,  $^1\text{O}_2$ ) and holes. Graphitic carbon nitride ( $\text{g-C}_3\text{N}_4$ ) has emerged as a promising polymeric photocatalyst, and its highly tunable properties allow  $\text{g-C}_3\text{N}_4$  with enhanced photocatalytic activity for environmental remediation. The selective oxidative species production of  $\text{g-C}_3\text{N}_4$  was observed in our previous work, but its mechanism and application for contaminant oxidation are largely underexplored. Here, we systematically evaluated oxidative species production of a suite of  $\text{g-C}_3\text{N}_4$  samples, and revealed their roles in contaminant oxidation via simulation and experimental tools. First, we quantified ROS production of  $\text{g-C}_3\text{N}_4$  synthesized from different precursors (i.e.,  $\text{MCB}_{0.07}$ , from melamine, cyanuric acid, and barbituric acid by a supramolecular approach, and U from urea by thermal polycondensation) under visible light irradiation (Xenon lamp,  $\lambda > 400$  nm). The results indicated that  $\text{MCB}_{0.07}$  produced 2.5 times more  $^1\text{O}_2$  compared to U, but a similar amount of  $\text{O}_2\text{-}\bullet$  and negligible  $\bullet\text{OH}$  were observed for both samples. Next, the second-order reaction rate constants of ROS with contaminants will be estimated by competition kinetics experiments. The surface-mediated hole oxidation of contaminants, including the thermodynamics (i.e., energy levels) and kinetics (i.e., reaction rate), will be investigated by density functional theory (DFT) and molecular dynamics simulations. In summary, this study will generate mechanistic insights of selective oxidative species production of  $\text{g-C}_3\text{N}_4$  and oxidative species-contaminant interactions, and it will provide guidelines for the rational design of  $\text{g-C}_3\text{N}_4$  as an effective visible-light-responsive photocatalyst for sustainable water treatment.

#### PRIMARY PRESENTER

Qinmin Zheng

#### STATUS

Student – Graduate

#### AUTHOR

Qinmin Zheng

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

Danmeng Shuai



## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

### RNA Profiling of Whole Blood Reveals Strong Markers of Neutrophil Activation in Lung Infections

#### BACKGROUND

Peripheral blood is an easily accessible and informative source of changes in the transcriptome due to bacterial and viral infections. Remarkably, the white cell count is a standard, but insensitive and unreliable measure of internal infections. RNA profiling of whole blood was used to identify transcripts which could provide better sensitivity to internal infections.

#### METHODS

Tempus tubes were collected from 17 patients presenting to the ED with suspicion of lower respiratory infection (LRI), and compared with a similar number of patients with non-infectious complaints, such as hernia. Total RNA was prepared, DNase treated, and further purified using MinElute columns, and quantified by the A260/280 ratio on spectrophotometer. Discovery of differentially expressed was performed on Illumina BeadChip arrays, and then validated and extended using the droplet digital PCR (ddPCR).

#### RESULTS

A striking elevation of 2-50 fold in a number of neutrophil defensins (i.e. DEFA1) was observed in patients with LRI. Initially, several LRI subjects with normal levels of DEFA1 appeared to be outliers, but closer inspection of their clinical records indicated that the final diagnosis was likely non-infectious, such as asthma, pneumonitis, amiodarone toxicity, or pulmonary embolism. Related studies indicated that the ability to detect DEFA1 and related innate immune markers was highly dependent on the type of blood preservative used, with Tempus tubes yielding ~4-6 fold better levels than Paxgene.

#### CONCLUSIONS

RNA levels of DEFA1 in whole blood are potentially a highly sensitive measure of neutrophil activation by internal infections, in this case, in the lungs. DEFA1 RNA levels could be quantified as rapidly as a white blood cell count, and provides greater molecular information about activation of the innate immune system by pathogens. Immune transcripts were highly sensitive to the method of collection of the RNA, possibly explaining why prior studies have not detected this strong induction of DEFA1 in lung infection cases.

#### PRIMARY PRESENTER

Zeynep Arslan

#### STATUS

Student – Graduate

#### AUTHORS

Nikhila Janakiram

#### AUTHORS

Zeynep Arslan

Nikhila Janakiram

Maha Alfaraidhy

Ian Toma

Raymond Lucas

Danielle Davison

Andrew Meltzer

Yndia Cooper

Michael Seneff

Timothy McCaffrey

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

Timothy McCaffrey



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Botox and Bipolar Disorder

Bipolar disorder (BD) is one of the top 10 impairments for individuals worldwide. BD medications reduce symptoms of mania or depression to help maintain euthymia. Antipsychotics are typically prescribed to treat manic episodes. Though antidepressants are commonly used to treat depressive episodes, their effectiveness is still in question. Lithium is deemed as the most effective form of medication to help treat BD. However, it is estimated that almost 50% of all BD patients will experience treatment resistance.

A new possible form of treatment for BD is injecting botulinum toxin A (BT) into patients' frown lines. Charles Darwin noticed that most people experiencing sadness had omega sign between the eyebrows, and that the omega sign would disappear when people became happier. William James claimed that physical portrayals of melancholy, such as a frown, could influence people's emotions. This has recently been given the name, "emotional proprioception."

Several studies have revealed that 50-60% of depressed patients responded well to BT being injected into the frown.

Mr. A is a 51-year-old BD patient who has had approximately 9 depressive episodes coupled with moments of suicidal thoughts. During one manic episode, Mr. A became a threat to his family's safety and had to be hospitalized.

Mr. A was taking several psychiatric medications since he was diagnosed with BD, such as divalproex 250 mg, ziprasidone 40 mg, clonazepam 0.5 mg, lamotrigine 100-200 mg, lithium 300 mg, sertraline 50 mg, olanzapine 5 mg, and zolpidem ER 12.5 mg at bedtime. Additionally, Mr. A received psychotherapy. The medications helped Mr. A at periodically throughout the course of his treatment. However, some of the medications triggered or exacerbated depression.

Mr. A received 40 units of botulinum toxin A in his frown lines for depression. Prior to the treatment, Mr. A scored a 20 on the Beck Depression Inventory-II (BDI-II). One week after the BT injection, Mr. A's BDI-II dropped to a seven, and about one month later, Mr. A's BDI was zero.

Contraction of the frown muscles may activate the amygdala, triggering distress and negative emotions. Botulinum toxin A may diminish amygdala over activity by temporally removing an individual's frown lines. This reduces the effects negative emotions have on people, especially BD patients.

---

#### PRIMARY PRESENTER

---

Jared Axelowitz

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHORS

---

Jared Axelowitz

Eric Finzi

Daniel Lieberman

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Daniel Lieberman



## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

### Evaluating the Association between Hidradenitis Suppurativa Disease Activity Scores and Marijuana Use

#### INTRODUCTION

Hidradenitis suppurativa (HS) is a chronic, recurrent, inflammatory disease of the apocrine sweat glands, characterized by recurrent abscessing inflammation. The disease affects 1-4% of the population and has no known cure. HS has several known risk factors, one of which is tobacco. Smoking is strongly correlated with disease activity in HS, and thus all patients are counseled to stop smoking.

Pain is common in HS and patients often use marijuana for pain management; however, the impact of marijuana on disease activity has not been investigated. The purpose of this study is to investigate the relationship between marijuana use and HS disease activity.

#### METHODS

This research was conducted through the Wound Etiology and Healing Study (WE-HEAL Study), an observational biospecimen and data repository approved by The George Washington University IRB (041408). All subjects gave informed consent for longitudinal data collection while receiving treatment according to standards of care. Baseline smoking and marijuana (MJ) use were documented from history obtained by the physician at initial visit. MJ use was a binary variable; cigarette smoking was categorized as current, former or never, and quantified. Disease activity scores including Hurley stage, Hidradenitis Sartorius Score (HSS) and Active Nodule (AN) count are documented at baseline and subsequent visits. Statistical analysis was performed using GraphPad Prism (Version 5, GraphPad, USA) and  $p < 0.05$  for all variables) and pain scores were comparable. There were no significant differences in disease activity at enrollment between the MJ users and non-users based on Hurley stage ( $p = 0.399$ ), HSS ( $p = 0.589$ ) or AN count ( $p = 0.32$ ). However, HSS and AN count tended to be higher in MJ users.

#### DISCUSSION

This study has several notable limitations. Firstly, MJ exposure was determined by patient report and exposure was not quantified, meaning under reporting of exposure was possible. Secondly, the number of MJ users in this study is small, limiting our ability to identify significant differences. Finally, the impact of MJ on disease activity in patients receiving other treatments for HS was not investigated.

#### CONCLUSION

The longitudinal observational cohort of HS patients followed in the WE-HEAL study is a unique population for investigating drivers of disease activity in HS.

#### PRIMARY PRESENTER

Jency Boyce

#### STATUS

Student – Undergraduate

#### AUTHORS

Jency Boyce

Sean McNish

Anirban Banerjee

Victoria Shanmugam

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

Victoria Shanmugam



## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

### Ultrasensitive Microanalytical CE-nanoESI-MS for Bottom-Up Proteomic Characterization of Mouse Hippocampal Neurons

Unbiased proteomic characterization of neurons provides information on molecular processes involved in normal development of the nervous system. However, sensitive detection technology is required to address cell-to-cell heterogeneity, specifically those capable of measuring trace amounts of proteins in single cells or small populations of neurons. High-resolution mass spectrometry (HRMS) excels at identifying proteins from large populations, usually millions of cells. Here, we report a HRMS-based microanalytical platform that enables ultrasensitive characterization of proteins from small populations of neurons in the mouse cerebral cortex. Our platform integrates a custom-built capillary electrophoresis (CE) nanoelectrospray ionization (nanoESI) interface for HRMS to achieve trace-level sensitivity. First, we constructed micro-loading stage capable of injecting 1 nL of peptides into a CE capillary where peptides were electrophoretically separated by applying 21 kV across the 90-cm fused silica capillary. The peptides were then ionized in a custom-built CE-nanoESI source that features a tapered-tip metal emitter to generate stable cone-jet regime. Using peptide standards, the CE-nanoESI-HRMS platform was characterized with an  $\sim 260$ -zmol (156,000 copies) lower limit of detection and high separation power ( $\sim 330,000$  theoretical plates). The instrument was able to detect  $\sim 15$  amol ( $\sim 1$  pg) of bovine serum albumin and cytochrome c in a bottom-up approach, raising sufficient sensitivity to measure proteins in small neuron populations. We utilized this platform to analyze  $\sim 500$  pg of protein digest from cultured hippocampal neurons isolated from pup mouse (embryonic day 16). The platform was able to identify over 1,000 different peptides belonging to 361 nonredundant protein groups ( $< 1\%$  FDR). The label-free quantitation intensities calculated for these proteins suggested a 4-log-order dynamic concentration range. Identified proteins were enriched in many genes that are classical neuron markers. Ultrasensitive characterization of proteins by CE-nanoESI-HRMS raises new potentials to investigate how differential gene expression establishes neuron heterogeneity for normal brain function.

#### PRIMARY PRESENTER

Sam Choi

#### STATUS

Student – Graduate

#### AUTHORS

Sam Choi

Eric Corcoran

Marta Zamarbide

M. Chiara Manzini

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

Peter Nemes



---

## ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS

---

### Combating Maternal Mortality: Analyzing the Three Delay Model to Provide Maternal Care in Remote Regions

The world has made significant strides in reducing maternal mortality globally, but it remains a debilitating problem in the most remote regions, which have little access to safe and adequate medical facilities and cannot be easily reached via roads. This study focused on the Three Delay model, which outlines the factors that result in maternal mortalities given that most occur because of delays in receiving proper treatment during a pregnancy (i.e. delays in deciding to seek medical assistance, reaching the nearest medical facility, and receiving appropriate and timely treatment). This study attempts to widen the research on (1) the biggest challenges to lowering maternal mortality in remote regions, (2) initiatives countries are taking to improve the situation and if they've been successful, and lastly (3) innovative technology to improve access to maternal health care in these regions. Data was collected by reviewing secondary sources and interviewing academics, local non-profit leaders, and members of UN organizations, including the Director-General of the World Health Organization. The countries of focus were Nigeria, India, and Bangladesh. This study found that the biggest challenges for the average woman in these countries to carry out a successful pregnancy were lack of healthcare personnel, shortage of well-functioning equipment, and unreliable sources of electricity and water. These countries have created programs to train midwives to respond to complications, provide transportation in the most unreachable areas, and communicate with doctors in other parts of the country through the use of telemedicine. There is still much work to be done—but through new innovations and initiatives by governments with the goal of women's empowerment, easily avoidable complications no longer need to lead to fatalities, and millions of children can know their mothers.

---

#### PRIMARY PRESENTER

---

Yuval Cohen

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHOR

---

Yuval Cohen

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Ron Waldman



## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

### Access and Barriers to Communication Services for Transgender and Gender Non-Conforming Individuals

#### BACKGROUND

An assessment of transgender (TG) and gender non-conforming (GNC) people of color's access to voice and communication services is needed in order to document and address health care disparities. Best practice guidelines for exploratory and qualitative research suggests preceding large surveys with small focus groups, both to identify salient themes and evaluate drafts of survey.

#### METHOD

Two focus groups were conducted in local safe-spaces for LGBT community. Eleven people representing all minority races and gender identities participated. The specific purpose of the group was to discuss goals related to gender transition/presentation, barriers to those goals, and to critique a survey regarding these issues for use by a wider audience.

Seven researchers read transcripts of the focus groups to independently identify and rank salient themes. After consensus of themes and organization along the continuum of Levesque's Access to Care model, transcripts were coded for occurrences of themes.

#### RESULTS

Four salient themes, two with subthemes, were identified: 1. Understanding the processes involved (uninformed, misinformed, informed), 2. Acceptance of identity (by self, family and friends, employers, society), 3. Affordability, and 4. Desire for services.

Overall, themes of Acceptance of identity and Desire for services were most frequent; affordability was the least common theme, likely reflecting that participants were still discovering information and considering the socio-emotional value of available services (both general and voice) and had not yet reached the stage of considering feasibility.

Specific to voice, Desire for voice change was the most frequent topic, followed by Processes Involved, for which comments were usually either misinformed (30/141) or completely uninformed (57/141). This is a stark contrast to the understanding of general Processes Involved, where the majority of comments involved accurate information (93/118). Most Acceptance themes related to self-acceptance(65/105) and to acceptance by society in general (24/105). In contrast, non-voice issues related to Acceptance most frequently addressed friends and family (92/218). Themes suggest that voice services could improve acceptance by self and society at large, but acceptance in personal relationships involve more than voice change.

#### DISCUSSION

These findings tentatively confirm hypotheses that TG and GNC people of color are not accessing voice and communication services. Based on this small sample, lack of information about services is a barrier to receiving voice care. Findings from this focus group provide rationale to distribute a survey nationally to investigate avenues to address barriers to care.

#### PRIMARY PRESENTER

Sierra Downs

#### STATUS

Student – Graduate

#### CO-PRESENTER

Adrienne Hancock

#### AUTHORS

Sierra Downs

Adrienne Hancock

Alyssa Giegerich

Kristen Davis

Dara Yazdani

Emily Chessher

Michael Ferguson

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

Adrienne Hancock



## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

### Differential Gene Expression in Primary Human CD4+ T Cells Induced by HIV Nef

#### BACKGROUND

The Nef protein is responsible for T-cell activation and formation of a persistent state of infection in HIV disease. Findings from the Sydney Blood Bank Cohort and other case studies indicate that individuals infected with a variant of HIV containing a defective *nef* gene displayed a slower development to AIDS compared to individuals infected with wild-type HIV. Our study investigates the role of the Nef protein on cellular gene transcription in infected primary CD4+ T cells with the goal of understanding how HIV Nef promotes viral replication and subsequent cellular pathology.

#### METHODS

To assess the effect of Nef on gene expression, RNA sequencing was done on 6 samples. In 3 control samples, we infected primary human CD4+ T cells with the wild-type HIV genome (NL4-3 Vpr mCD24  $\Delta$ -Env Wt-Nef). In the 3 experimental samples, we infected additional cells with a Nef-deleted variant of HIV (NL4-3 Vpr mCD24  $\Delta$ -Env  $\Delta$ -Nef). The NL4-3 genome was introduced into the CD4+ T-cells through a pseudovirus infection. After 24 hours of infection, cells containing the HIV genome were then enriched through positive selection using anti-mCD24 microbeads. The mRNA was isolated using Trizol and subsequently reverse transcribed into complementary DNA. This cDNA seqments for each sample were sequence using High Throughput DNA Sequencing. We used the "Green line" on DNA Subway to analyze and compare the differential gene expression between our two conditions. DNA Subway incorporates open source components and uses the Tuxedo protocol to analyze and compare transcriptome gene expression. R-Programming was used for the statistical and graphical analysis.

#### RESULTS

We found that 19 statistically significant differentially expressed genes due to the presence of Nef. Out of the 19 genes, 11 of them showed decreased expression from Wild-type to  $\Delta$ Nef and 8 of them showed increased expression from Wild-type to  $\Delta$ Nef. Some immune related genes of interest include ISG20 and IL15.

#### CONCLUSION

The Nef protein, which has been shown to be fundamental in AIDS progression in the clinic, does have a cellular effect on gene transcription. We are continuing to investigate these Nef-regulated genes to decipher Nef's role in pathology at the cellular level. Our next step is to validate these gene frequencies by using qRT-PCR.

#### PRIMARY PRESENTER

Ryan Goydos

#### STATUS

Student – Undergraduate

#### CO-PRESENTER

Karol Suchowiecki

#### AUTHORS

Ryan Goydos

Karol Suchowiecki

Ayub Ali

Otto O. Yang

Douglas F. Nixon

Robert L. Furler

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

Robert L. Furler



## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

### Pilot Program To Evaluate Feasibility and Effectiveness of Referring Emergency Department Patients to Social Service Programs

#### OBJECTIVES

The purpose of this research is to measure the unmet medical and social needs of emergency department (ED) patients insured by the District of Columbia (DC) Medicaid program and to determine whether patients who have one or more unmet needs will seek services after they leave the ED if we provide them with a referral to a community-based organization that addresses their particular need(s).

#### METHODS

We conducted a pilot screening and referral program in the George Washington University Hospital ED for 3 months. We screened adult patients insured by the DC Medicaid program for medical and social unmet needs. If they requested assistance with an unmet need, we referred them to specific community-based agencies that agreed to track whether the patients obtained the services. We used Aunt Bertha (AB) as our referral tool. When we referred patients to an agency through AB, it sends patient referral information to the referral agency and it sends the patient information about the referral agency. We also gave subjects printed information about the agencies before ED discharge. Three weeks later, we attempted to call all subjects who received at least one referral to determine if they contacted the community agency(s). We also followed-up with the referral agencies to determine if they provided assistance to any referred subjects.

#### RESULTS

We screened 275 subjects and referred 81% (N=224) to at least one community-based agency. Approximately two-thirds of the sample is female (69%) with a mean age of 38. Sixty percent report working full or part-time and only 15% do not have a high school degree. Forty-three percent reported housing instability. Almost half of the sample (43%) has children living with them. The most prevalent unmet needs were related to housing (68%), medical (49%), food (41%), job training (28%) and legal (28%). The percentage of subjects assisted according to the referral agencies ranged from 0% for the legal agency to 64% for a managed care organization (MCO). Among those we successfully interviewed at follow-up (72%), subjects reported slightly higher assistance rates (range of 4% to 19%) compared to the agency-reported assistance rates, with the exception of the MCO (19%).

#### CONCLUSION

There is a high prevalence of unmet medical and social needs among adult, DC Medicaid beneficiaries treated in our ED. Despite the high unmet need, a relatively small percentage of subjects obtained services from the community agencies at least one month after referral.

#### PRIMARY PRESENTER

Satomi Hiya

#### STATUS

Student – Undergraduate

#### CO-PRESENTERS

Daniella Olonilua

Kathryn Marcon

#### AUTHORS

Satomi Hiya

Kathryn Marcon

Daniella Olonilua

Samuel Johnson

Andrew Long

Humna Ajaz

Shelly Sharma

Paige Kulie

Melissa McCarthy

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

Melissa McCarthy



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Nociceptive Immunity: Metabolic Implications via Allatostatin C

Traditional models of the pain-response to infection by foreign noxious agents depict the sensation due to the secondary effects of immune infiltration (inflammation, release of cytokines, etc.). However, recent findings have indicated a relationship between pain and bacterial infection in mice. This relationship was through direct activation of pain-sensing neurons (nociceptors) by bacteria, rather than secondary to the immune response. In adapting this model to *D. melanogaster*, we are focused on allatostatin, a protein product released by nociceptors upon activation. Allatostatin is a homolog of the human somatostatin, which is implicated in having immunosuppressive effects. In preliminary survival experiments, flies with AstC-R2 silenced (allatostatin C receptor 2), had the shortest lifespans on average. Most importantly, allatostatin also has whole-organism effects, so ultimately, we want to determine whether or not the decreased survivorship in AstC-R2 silenced mutants is due to immuno-modulating or metabolic effects. For elucidation of allatostatin's role in immunity, we will generate flies where AstC-R2 expression will be silenced in specific tissues and ubiquitously. We will conduct survival experiments by infection with *P. luminescens* bacterial strain and measure changes in metabolic activity of the mutants by staining intracellular lipid droplets. We anticipate to discover that the decreased survivorship among AstC-R2 mutants is independent of metabolic effects and is rather due to the lack of receptors on hemocytes. If this is the case, then future studies will seek to uncover the immunological mechanisms associated with the decreased survivorship of the AstC-R2 silenced flies. Future impacts that this study will hopefully contribute to would include identifying a framework for targeting chronic pain and autoimmune diseases in humans.

---

#### PRIMARY PRESENTER

---

Gary Hovsepian

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHORS

---

Gary Hovsepian

Nathaniel Bachtel

Douglas F. Nixon

Ioannis Eleftherianos

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Ioannis Eleftherianos

Douglas F. Nixon



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Mitomycin C Affects the Migration of Human Corneal Limbal Epithelial Cells

Soon after superficial corneal wounds have healed, spontaneous erosion of corneal epithelial cells can occur, leading to pain, corneal infection and scarring. Studies performed *in vivo* on mice in our lab have shown that treatment of the cornea with DNA crosslinker Mitomycin C (MMC) reduces erosion frequency and enhances corneal wound healing. The mechanism(s) used by MMC to reduce recurrent erosions are not understood. Here, we assess both direct effects of MMC treatment and potential indirect effects by using conditioned media (CM) from MMC treated fibroblast cells. Topically applied MMC exposes both epithelial cells and fibroblasts to the drug. The goal of this *in vitro* approach is to simulate what happens *in vivo*.

Using Human Corneal Limbal Epithelial (HCLE) cells *in vitro*, we ask: How does MMC affect the migration of HCLE cells? We try to answer this question via 3 experiments.

First, time lapse migration studies were performed using HCLE cells treated directly with MMC or indirectly with MMC CM. MMC treated cells migrated slower than control, while cells treated with the MMC CM also migrated slower than control but faster than those directly treated with MMC.

Second, qPCR of genes that have been implicated in cell migration and wound healing may provide further insight about which mRNA transcripts may be at work post-MMC treatment. Examples of these genes are mitogens such as chemokine ligand 1 (CXCL1), and vascular endothelial growth factor A (VEGFA), or the urokinase receptor (PLAUR) that function in tissue reorganization during wound healing. Preliminary results have shown an upregulation of CXCL1 after MMC treatment relative to the control and after MMC CM relative to the control CM. Both PLAUR and VEGFA do not show a statistically significant change relative to the control post-MMC. To confirm these mRNA are indeed translated into proteins, we will perform Western Blots on select genes.

Third, a detachment assay shows that MMC treated cells detach much faster than controls. Prior studies also found that the treated cells adhere less than their controls. Taken together, these studies indicates that MMC affects migration indirectly by altering metabolism in epithelial cells. Stimulation of the senescence-associated secretory phenotype (SASP) may decrease migration without altering cell adhesion. To explore this possibility further, current studies are being conducted to quantify protein synthesis and mitochondrial activity within control and MMC treated HCLE cells.

---

#### PRIMARY PRESENTER

---

V. Rose Lieberman

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHORS

---

V. Rose Lieberman

Sonali Pal-Ghosh

Mary Ann Stepp

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Mary Ann Stepp



## SCHOOL OF NURSING

### Maternal Depression: Perinatal Nurses Perceived Attitudes, Beliefs and Practices

#### AIM

To report and better understand perinatal nurses attitudes, beliefs and practices in relation to assessment and intervention of maternal depression in an acute care setting prior to discharge using the Depression in Women's Health Settings -Nurse Version survey, in labor and delivery, postpartum and the neonatal intensive care unit (NICU) by comparing years of experience in nursing and level of education.

#### BACKGROUND

Postpartum depression is a mood disorder that affects up to 600,000 to 800,000 women annually. While depressive symptoms are common in the postpartum period, literature suggests the reported incidence of 10-20% is likely an underestimate, but precise screening rates for postpartum depression are unknown. Early detection practices are not currently positioned to optimize outcomes in postpartum women and there is little available literature evaluating the attitudes, beliefs and practices of perinatal nurses in assessing and evaluating maternal depression in the acute care setting.

#### DESIGN

A cross-sectional survey design was used to describe the attitudes, beliefs, and practices of perinatal and neonatal nurses concerning the management of symptoms of maternal depression. The instrument contains 54 questions, 7 demographic and 47 Likert scale.

#### METHODS

The proposed sample consisted of perinatal nurses from labor and delivery, postpartum, and the Neonatal Intensive Care Units (NICU) in a Northern Virginia community hospital. Convenience sampling was used to recruit participants. The sample size of the study included 116 eligible participants with 32 surveys returned.

#### RESULTS

Data was not sufficient to draw conclusions concerning nursing attitudes, beliefs and practices for nurses with less than 5 years of nursing experience,  $n=3$ . Differences were seen in the level of confidence and perceived responsibility for assessing, intervening and counseling women with maternal depression. Additionally, nurses with a bachelor's degree or higher reported greater familiarity with DSM criteria, however both groups demonstrated willingness to use a standardized screening tool. Time limitations were reported as the greatest barrier in assessment, intervention and referral.

#### CONCLUSIONS

While this study had small numbers of respondents and statistical significance was not found in either years of nursing or level of education, the data identifies that maternal and postpartum depression continuing education is necessary if nurses are to increase levels of confidence and apply the knowledge in the areas of assessment, intervention and referral. In addition, utilization of a standardized screening tool appears to be a welcome change to practice. Study replication with more participants is necessary to draw more widespread conclusions.

#### PRIMARY PRESENTER

Rebecca Mance

#### STATUS

Student – Graduate

#### AUTHORS

Rebecca Mance

Billinda Tebbenhoff

Karen Wyche

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

Billinda Tebbenhoff



## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

### Patients with Scleroderma Sine Scleroderma Exhibit Lower Disease Activity Scores than Limited and Diffuse Scleroderma Patients

#### INTRODUCTION

Scleroderma is an autoimmune disease characterized by inflammation, vasculopathy, and fibrosis of skin, vasculature and internal organs. Scleroderma without extensive skin involvement is referred to as Scleroderma Sine Scleroderma; these patients have positive scleroderma autoantibodies and can develop internal organ involvement but usually have minimal or no skin involvement. The purpose of this study was to investigate differences demographics and disease progression between limited, diffuse and sine scleroderma patients.

#### METHODS

This research was conducted through the STOP Scleroderma Study. The STOP Scleroderma Study is a longitudinal biospecimen and data repository approved by the George Washington University IRB (051427). Subjects gave written informed consent for collection of their data. Demographics including, age, sex, and race were compared between the groups. Disease activity scores were also analyzed including modified Rodnan skin score (mRSS) and Medsger's severity score. Statistical tests including T-test, Fisher's Exact and Chi Square were performed using GraphPad Prism 5.0.

#### RESULTS

The analysis included 8 patients with scleroderma sine scleroderma, 26 patients with limited scleroderma and 15 diffuse scleroderma patients. Patients with scleroderma sine scleroderma were younger (mean age  $44.66 \pm 13.91$ ), than diffuse ( $52.09 \pm 13.90$ ), and limited ( $60.58 \pm 12.60$ ) patients ( $p=0.01$ ). However, there were no significant differences in race or sex. As expected sine patients had significantly lower mRSS ( $0 \pm 0$  in sine, compared to  $12.43 \pm 9.24$  in diffuse, and  $5.28 \pm 4.29$  in limited,  $p<0.0001$ ). Medsger severity scores were also lower in patients with sine ( $0.143 \pm 0.378$ ) compared to diffuse ( $5.71 \pm 3.85$ ) and limited ( $3.125 \pm 1.60$ ,  $p<0.0001$ ). When examining the antibody profiles of sine patients, 87.5% had positive ANA, 37.5% had a positive Scl-70, 25% had a positive Centromere, and 12.5% had a positive RNP. Over longitudinal follow up, the mRSS did not change from baseline; however, Medsger severity score increased over follow up by  $0.357 \pm 0.67$ . Peripheral vascular complications developed in 25% of patients and lung complications in 12.5% of patients.

#### CONCLUSION

Sine scleroderma patients are significantly younger than limited and diffuse scleroderma patients. Further, sine scleroderma patients present with a significantly lower baseline mRSS and Medsger score. Patients with positive scleroderma antibodies but minimal skin involvement should be followed long term in order to monitor for internal organ complications of scleroderma.

#### PRIMARY PRESENTER

Marissa Mangini

#### STATUS

Student – Undergraduate

#### AUTHORS

Marissa Mangini

Sean McNish

Anirban Banerjee

Victoria K. Shanmugam

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

Victoria K. Shanmugam



## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

### Low-Calorie Sweetener Use is Associated with Obesity Risk Among Children and Adolescents in the United States

#### BACKGROUND

Low-calorie sweetener (LCS) consumption has increased markedly in children. While LCS offer a lower-calorie alternative to added sugars, their effectiveness for weight management and metabolic health is unclear and little is known about the association between LCS consumption and body weight in children. We therefore aimed to investigate whether LCS consumption is associated with calorie intake and body weight in children using national-level dietary, anthropometric, and demographic data collected from five cycles (2005-2014) of the National Health and Nutrition Examination Survey (NHANES).

#### METHODS

Data were collected from NHANES participants aged 2 to 19 years, providing a total sample of 16,274 individuals. Demographic information, including age, sex, socioeconomic status, and self-reported race-ethnicity, anthropometric values, including height and weight, and dietary data collected in NHANES were categorized and analyzed consistent with prior reports. Multinomial logistic regression, first unadjusted, and subsequently adjusted for age, sex, race/ethnicity, income, total energy intake, and physical activity, was used to estimate the odds of obesity in LCS consumers vs. non-consumers. After excluding individuals who were underweight or who reported implausible energy intake, the final sample consisted of 15,716 individuals.

#### RESULTS

The odds of obesity were 22% and 32% higher in LCS consumers compared to non-consumers, in unadjusted and adjusted models, respectively. Increased obesity risk was most pronounced among LCS beverage consumers vs. non-consumers and specifically among adolescents, non-Hispanic white and Hispanic participants. Higher odds of obesity were observed among LCS consumers in both males and females and across all family income subgroups.

#### DISCUSSION

Our findings indicate that, even after adjustment for multiple confounders and covariates, LCS consumption is associated with obesity among children and adolescents. These results, in combination with the well-established notion that LCS may exert clinically relevant metabolic effects despite being non-nutritive, emphasize the need for further investigation into the mechanisms by which LCS may induce metabolic dysregulation. As obesity rates among children and adolescents continue to rise, it is essential to elucidate the potential role of widely consumed LCS in weight management and metabolic health. Furthermore, as differences in obesity risk based on LCS use were observed across socio-demographic subgroups, it is important to consider race/ethnicity, gender, age, and other factors in the design and interpretation of clinical studies evaluating LCS effects.

#### PRIMARY PRESENTER

Kevin Mathieu

#### STATUS

Student – Undergraduate

#### AUTHORS

Kevin Mathieu

Yichen Jin

Sameera A. Talegawkar

Allison Sylvestsky Meni

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

Allison Sylvestsky Meni



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Conservation of Developmental Diapause in *Heterorhabditis Bacteriophora*, *Ancylostoma Caninum*, and *Caenorhabditis Elegans*

Developmental arrest is an important and common feature of nematode development. Many parasitic and non-parasitic nematodes have arrested third stage larvae (L3), or dauers, that may be either obligate or facultative stages in the life cycle. In addition, the non-parasitic nematode *Caenorhabditis elegans* facultatively undergo a dormant first larval (L1) stage in response to starvation. Similarly, the free-living stages of the hookworm life cycle occur in the environment, and could conceivably be subject to adverse conditions such as starvation. In contrast, entomopathogenic nematodes [EPN], except for the non-feeding dauer juvenile dispersal stage, complete their entire life cycle in a food-rich environment within the host. Given the abundant availability of nutrients, an L1 arrest stage may no longer be necessary in this nematode. To determine if L1 arrest is conserved in the EPN *Heterorhabditis bacteriophora* and the hookworm *Ancylostoma caninum*, we plated eggs in the presence or absence of a bacterial food source. Worms were measured every 6 hours over a period of 5 days. In both nematode species, starved worms failed to develop past the L1 stage, whereas fed worms grew in length and molted. Furthermore, the starved L1 of both species that were later fed resumed development and molted. To investigate why L1 diapause is conserved in *H. bacteriophora*, we examined the effects of diapause on reproduction by recording the developmental stage and number of offspring produced by 48-hour starved and re-fed hermaphrodites. *H. bacteriophora* which entered L1 diapause laid fewer eggs than continuously fed worms. However, the eggs laid by starved worms had a higher hatch rate than the eggs of fed worms. Additionally, starved worms were more likely to undergo *endotokia matricida*, a process in which larval worms hatch inside the mother and consume her internal tissues. These results indicate that despite significant differences in life history and environmental conditions, both *A. caninum* and *H. bacteriophora* undergo starvation-induced developmental arrest at the L1 stage, suggesting conservation of this characteristic in nematodes. Additionally, L1 arrest may provide a reproductive advantage in the form of more viable offspring production during stress periods.

---

#### PRIMARY PRESENTER

---

Kristin Mounts

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHORS

---

Kristin Mounts

Camille Dowling

Jonathan Vadnal

John M. Hawdon

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

John M. Hawdon



## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

### Development of a Novel Non-Invasive Growth Plate Ablation Treatment Using Magnetic Resonance Imaging guided High-Intensity Focused Ultrasound (MR-HIFU)

#### PURPOSE

Current options for epiphysiodesis rely on open or percutaneous surgical techniques to induce physal destruction. Magnetic Resonance imaging-guided high-intensity focused ultrasound (MR-HIFU) is a novel modality that has been used to non-invasively treat prostate cancer, uterine fibroids, and bone metastases. The technology uses focused ultrasound to ablate tissue and relies on MRI to plan and monitor thermal ablation of precisely-defined targets. The purpose of this study was to evaluate the feasibility of performing epiphysiodesis with MR-HIFU in a pre-clinical large animal model and to assess its side effects.

#### METHODS

Six immature Yorkshire piglets aged 2-5 months underwent MR-guided HIFU of the proximal tibial physis in a research MRI suite with a 3T scanner under general anesthesia. The left proximal physis of the tibia was targeted with a HIFU device which delivered a thermal dose to the physis. The untreated right tibia served as normal controls. The animals were allowed weight-bearing as tolerated and observed daily. One animal was sacrificed at 48-hours post-HIFU treatment to assess acute tissue damage and the rest (n=5) at 10-weeks following MR-HIFU treatment to assess growth inhibition and chronic changes. Tibias were harvested and assessed using radiography for bone length between the proximal and distal physes, histology for growth plate damage, and immunohistochemistry (TUNEL) for the extent of cell death at the site of HIFU application. Statistical analysis used a paired t-test.

#### RESULTS

All animals recovered quickly and did not exhibit any deficits in gait, weight-bearing, or function during the 10-week observation period. In two animals a slight redness and swelling was observed in the proximal tibial region indicating mild subcutaneous inflammation post-HIFU treatment. Histologic and immunohistochemical assessments of 48-hour post-HIFU specimen revealed extensive cell death in the targeted growth plate cartilage region, adjacent trabecular bone, and marrow space. Measurement of tibial bone length on radiographs showed an average decrease of  $3.0 \pm 1.3\%$  length in HIFU-treated tibias vs. contralateral untreated tibias ( $p=0.004$ ). Histologic examination of the HIFU-treated physes revealed localized growth plate damage with replacement of the physis by bony bridge and fibrovascular tissue.

#### CONCLUSION

Our findings demonstrate the feasibility of non-invasive ablation of the proximal tibial physis using MR-HIFU in a large animal model.

#### SIGNIFICANCE

This is the first study to evaluate physal ablation using a MR-HIFU method, a technique that may provide a non-invasive alternative to current surgical treatments for limb-length discrepancy and angular deformity corrections. MR-HIFU has the potential to lower costs and morbidities associated with surgical methods.

#### PRIMARY PRESENTER

Kavita Prakash

#### STATUS

Student – Undergraduate

#### AUTHORS

Kavita Prakash

Pavel Yarmolenko

Olumide Aruwajoye

Haydar Celik

Robert M. Staruch

Debra Szczepanski

Karun Sharma

Aerang Kim

Kavita Prakash

Avinash Eranki

Rajiv Chopra

Peter Kim

Matthew Oetgen

Harry Kwang-Woo Kim

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

Pavel Yarmolenko



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### IFITM1 Targets HIV-1 Latently Infected Cells for Antibody-Dependent Cytolysis

HIV-1 persistence in latent reservoirs during antiretroviral therapy (ART) is the main obstacle to virus eradication. To date, there is no marker that adequately identifies latently infected CD4+ T cells in vivo. Using a well-established ex vivo model, we generated latently infected CD4+ T cells and identified interferon-induced transmembrane protein 1 (IFITM1), a transmembrane antiviral factor, as being overexpressed in latently infected cells. By targeting IFITM1, we showed the efficient and specific killing of a latently infected cell line and CD4+ T cells from ART-suppressed patients through antibody-dependent cytotoxicity. We hypothesize that IFITM1 could mark natural reservoirs, identifying an immune target for killing of latently infected cells. These novel insights could be explored to develop clinical therapeutic approaches to effectively eradicate HIV-1.

---

#### PRIMARY PRESENTER

---

Paul Zdinak

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHORS

---

Andre Raposo

Miguel de Mulder Rougvié

Dominic Paquin-Proulx

Phillip M. Brailey

Vinicius D. Cabido

Paul M. Zdinak

Allison S. Thomas

Szu-han Huang

Greta A. Beckerle

Richard B. Jones

Douglas F. Nixon

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Douglas F. Nixon



---

**COLUMBIAN COLLEGE OF ARTS AND SCIENCES**

---

## Overexpressed Somatic Alleles are Enriched in Functional Elements in Breast Cancer

Asymmetric allele content in the transcriptome can be indicative of functional and selective features of the underlying genetic variants. Yet, imbalanced alleles, especially from diploid genome regions, are poorly explored in cancer. Here we systematically quantify and integrate the variant allele fraction from corresponding RNA and DNA sequence data from patients with breast cancer acquired through The Cancer Genome Atlas (TCGA). We test for correlation between allele prevalence and cancer-implicated functionality in known cancer drivers, and then search for drivers-consistent allele patterns in the whole transcriptome. We document significant preferential expression of inactivating variants in tumor-suppressing genes. Most notably, we find substantial allele overexpression of variants that inactivate DNA-repair processes. We also report a list of variants that have not been implicated in cancer before, but whose allele patterns follow those of known cancer drivers. Overall, our analysis presents an integrated set of features that defines the somatic allele expression in breast cancer and points to the vast information content of the asymmetric alleles in the cancer transcriptome.

---

**PRIMARY PRESENTER**

---

Paula Restrepo

---

**STATUS**

---

Student – Undergraduate

---

**CO-PRESENTER**

---

Christian Miller

---

**AUTHORS**

---

Paula Restrepo

Mercedeh Movassagh

Nawaf Alomran

Christian Miller

Muzi Li

Chris Trenkov

Yulian Manchev

Sonali Bahl

Stephanie Warnken

Liam Spurr

Tatiana Apanasovich

Keith Crandall

Nathan Edwards

Anelia Horvath

---

**RESEARCH MENTOR/  
DEPARTMENT CHAIR**

---

Anelia Horvath



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### An Updated Institutional Review of Mastectomy and Contralateral Prophylactic Mastectomy Rates

Breast conservation (BCT) followed by radiation therapy has been shown to be as effective for long term survival of breast cancer as mastectomies, and is considered standard of care for patients who are candidates. However, patients are increasingly electing to have mastectomies with contralateral prophylactic mastectomies (CPM). A previous study from our institution observed factors that influenced patients to choose mastectomies over BCT between 2002 and 2009. The purpose of the current study was to observe mastectomy rates in our institution over the past 2 years and to evaluate factors for BCT-eligible patients who elected to have mastectomies with and without CPM.

A retrospective analysis was performed for 201 mastectomy surgeries among females between September 2013 and August 2015 at The George Washington University Breast Care Center. Patients who were eligible for BCT were compared to patients not eligible for BCT. Rates of CPM were also compared among those who were and were not eligible for BCT. Chi-squared test of independence was used to evaluate statistical significance.

Of 201 mastectomies performed, 34 were prophylactic and 167 were for cancer. Of the 167 for cancer, 97 (58.1%) were not eligible for BCT and 70 (41.9%) were eligible for BCT. Of mastectomy patients who were BCT-eligible, 49 (70.0%) also elected to have CPM ( $p \leq 0.001$ ), and 50 (51.5%) of patients not BCT-eligible also elected to have CPM. Of the 70 patients that were eligible for BCT but underwent mastectomy, 51 (72.9%) had invasive cancer, and 33 (64.7%) of those patients also elected to have CPM ( $p \leq 0.001$ ). There were 30 (42.8%) BCT-eligible mastectomy patients under age 50, 30 (42.8%) African American patients, and 26 (37.1%) White patients. Additionally, 45 (64.3%) had a family history of breast cancer. Of the 34 patients who underwent bilateral prophylactic mastectomies, 31 (91.2%) had a family history of breast cancer, of which 11 were BRCA negative, 11 were BRCA positive. There were 9 of the prophylactic patients who did not have testing but 3 had a personal history of breast cancer.

Mastectomy and CPM rates have been increasing at our institution, which has been observed by other authors. Preoperative diagnosis of invasive carcinoma, family and personal history of disease, age and race were found to be associated with mastectomy and CPM in this study. However, more studies observing BCT-eligible patients who elected mastectomy versus BCT are required to further evaluate the factors that impact patients' choices for surgical management.

---

#### PRIMARY PRESENTER

---

Cecilia Rossi

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHORS

---

Anita Sambamurty

Cecilia Rossi

Christine Teal

Anita McSwain

Claire Edwards

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Christine Teal



## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

### Clinical Indicators for Non-Accidental Trauma in a Pediatric Emergency Department Setting

#### INTRODUCTION

One in four children experience some form of abuse in their lifetime, with severe costs to the child and society (CDC, 2014). Non-accidental trauma (NAT) diagnoses may be initially missed in the Emergency Department setting. Subsequently, many hospitals have adopted a checklist system for identifying possible abuse (Crichton et al., 2016).

#### METHODS

This study retrospectively reviews clinical findings related to NAT patients in a pediatric ED from 2013 to 2015. Clinical cases of NAT were gathered via electronic medical records (N=173). Cases were selected based on presence of NAT diagnosis and ICD-9 coding for injuries indicative of potential child abuse. Factors examined include: child's age, triage acuity (Emergency Severity Index [ESI]), incident location, insurance type, prehospital transport type, and accompanying guardian relationship. Injury Severity Score (ISS) data were grouped into five categories based on severity of scores (greater than 8, 15, 24, and 40).

#### HYPOTHESES & RESULTS

Consistent with H1 as age decreased, frequency of abuse (H1) increased ( $r = -.263$ ,  $p < .001$ ,  $r^2 = .069$ ,  $n = 167$ ); and inconsistent with H2 as age decreased, ISS (H2) increased ( $r = -.130$ ,  $p < .088$ ,  $r^2 = .017$ ,  $n = 173$ ).

Consistent with H3 and H4 as triage acuity increased, frequency of abuse (H3) ( $r = -.159$ ,  $p < .047$ ,  $r^2 = .025$ ,  $n = 158$ ) and ISS (H4) ( $r = -.490$ ,  $p < .0001$ ,  $r^2 = .240$ ,  $n = 164$ ) increased.

Inconsistent with H5 and H6 as home in hotspot decreased, frequency of abuse (H5) ( $r = -.032$ ,  $p < .680$ ,  $r^2 = .001$ ,  $n = 167$ ) and ISS (H6) ( $r = .030$ ,  $p < .696$ ,  $r^2 = .001$ ,  $n = 173$ ) did not significantly increase.

Additionally: (1) Medicaid presence was not correlated with frequency of abuse ( $r = -.021$ ,  $p < .791$ ,  $r^2 = .0004$ ,  $n = 167$ ), nor with ISS ( $r = .042$ ,  $p < .586$ ,  $r^2 = .003$ ,  $n = 173$ ); (2) transport intensity was not correlated with frequency of abuse ( $r = -.125$ ,  $p < .116$ ,  $r^2 = .016$ ,  $n = 160$ ); yet was correlated with ISS ( $r = -.326$ ,  $p < .0001$ ,  $r^2 = .106$ ,  $n = 166$ ); and (3) the guardian's relationship to the patient was not correlated with frequency of abuse ( $r = .065$ ,  $p < .441$ ,  $r^2 = .004$ ,  $n = 141$ ), nor with ISS ( $r = .077$ ,  $p < .357$ ,  $r^2 = .006$ ,  $n = 146$ ).

#### DISCUSSION

The most pivotal correlates of child abuse appear to be: (1st) age ( $r^2 = .069$ ) and (2nd) ESI ( $r^2 = .025$ ); furthermore, injury severity is correlated with triage acuity ( $r^2 = .240$ ) along with transport type and ISS ( $r^2 = .125$ ).

One valuable takeaway from these data is how reliable predictors of child abuse and injury severity can provide further insight into an extremely important medical, psychological, and socio-economic issue. Future research could potentially identify key NAT indicators to develop a pediatric ED screening tool.

#### PRIMARY PRESENTER

Alexis Sandler

#### STATUS

Student – Undergraduate

#### AUTHORS

Alexis Sandler

Nils Olsen

Omar Ahmed

Jennifer Fritzeen

Andrew Bernstein

Mikael Petrosyan

Randall Burd

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

Nils Olsen



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Applicability of Family Art Therapy and Assessments: A Single Case Study of A Mother and A Child

#### OBJECTIVE

---

The family as a unit is often defined as the social context of an individual. Many mental health professionals recognize the merits of looking at and working with a client's family backgrounds to enhance treatment. Children who suffer from intense stress and exhibit defiant behaviors can benefit from family art therapy to enhance their coping and elucidate problematic family dynamics that contribute to the problem. Since art therapy relies on metaphoric language, family art therapy may be especially useful in cultures that have a taboo on open expression, particularly about one's family.

#### METHOD

---

A qualitative case study investigated the progress and benefits of family art therapy, conducted with one such child and his mother in South Korea. The child was referred for stress due to academic pressures and motor tic reactions. In addition to eight sessions of family art therapy, the clients completed the Kinetic Family Drawing (KFD) and the Family Art Psychotherapy (FAP) art assessments before and after the treatment sessions to provide comparative analysis of the participants' progress.

#### FINDINGS

---

In-depth narratives of the ten sessions (family art therapy sessions and assessments) closely explored family interactions and communication patterns as evidenced in their art making and artwork. Thematic analysis revealed three emerging themes: changed family dynamics, progress of the identified child, and significance of art to treatment.

#### IMPLICATIONS

---

This case study demonstrated the applicability of family art therapy and its benefits. The mother increased her warmth and flexibility in her parenting style. Accordingly, this enlarged the child's openness to express thoughts and feelings, which also empowered his resiliency of stress management. The progress of this case exhibits the value of family art therapy in a hierarchical family structure, as well as in a cultural context that emphasizes moral and ethical responsibility and where personal expression about one's family is discouraged.

---

#### PRIMARY PRESENTER

---

Min Kyung Shin

---

#### STATUS

---

Student – Graduate

---

#### AUTHOR

---

Min Kyung Shin

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Jordan S. Potash



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Temporal Dynamics of the Effect of HDAC Inhibitors on the Melanoma Transcriptome Using the Nanopore MinION

Histone deacetylases (HDACs) modify a variety of proteins involved in cellular processes both related and unrelated to the chromatin environment. However, while the effects of HDAC inhibitors (HDACi) in the cell cycle are well-documented, their role in immunobiology is not yet fully understood. Recently, research has found that the inhibition of HDAC6 enhances *in vivo* anti-tumor responses and inactivates important negative regulators of immune function, including PD-L1 and PD-L2. As a result, HDAC6i have emerged as potential therapeutic anti-cancer agents due to their multiple effects on immune-related pathways in cancer cells. However, many of the genes involved in these pathways are still unknown. In order to identify which genes are affected by HDACi, gene expression levels of SM1 melanoma cells treated with Nexturastat (an HDAC6 inhibitor) for different time periods will be sequenced using both the Illumina HiSeq2000 and the Oxford Nanopore MinION sequencer. The SM1 cells will be treated for time periods of 0 minutes, 30 minutes as well as 1, 2, 4, 8, and 24 hours. Computational models will be applied to explore the temporal dynamics of the gene expression across the aforementioned time-scale using the TopHat/Cufflinks and Samtools packages. The study aims to uncover patterns of expression that will identify correlations between HDAC inhibition and expression levels of potentially oncogenic genes. Therefore, the experiment will provide insight into the participation of the HDAC-regulated immune pathways in anti-tumor immune responses. Further research into these pathways involved in regulatory processes is key to designing new chemotherapeutic drugs.

---

#### PRIMARY PRESENTER

---

Liam Spurr

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHORS

---

Liam Spurr

Alexander Barnes

Christian Miller

Paula Restrepo

Muzi Li

Alejandro Villagra

Anelia Horvath

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Anelia Horvath



## CORCORAN SCHOOL OF THE ARTS & DESIGN

### Stability and Flexibility in the Modular Organization of Resting Networks in Depression

#### OBJECTIVE

Although prior work has demonstrated that modularity analysis can characterize unique network disruptions in disease states, it is unclear whether (1) modularity analysis can reveal robust, specific patterns of network organization in graphs constructed at the level of the individual in a depressed sample, (2) whether the patterns of network organization are stable versus flexible across time and (3) if specific features of network connectivity over time are clinically relevant. We aimed to address these three issues in a well-powered sample assessed at two time points.

#### METHODS

166 unmedicated outpatients with major depressive disorder (aged 18-63 years; 59% female) from the International Study to Predict Optimized Treatment in Depression (iSPOT-D) imaging sub-study and 58 matched healthy controls completed resting-state baseline imaging. Patients were then randomized to one of three antidepressants and both patients and controls were re-imaged after 8 weeks. We defined regions of the DMN and Salience Network using an established parcellation, with which we applied graph theoretical models. First, we characterize the degree of inter-subject variation in subnetwork organization of the DMN and Salience network for MDD patients and healthy controls. Second, we assess the extent of stability/flexibility in subnetwork structure from baseline to follow-up, via a newly defined "stability metric". Third, we test whether the degree of stability/flexibility in subnetwork structure pre- to post-treatment was associated symptom improvement.

#### RESULTS

In regard to our first aim, individual graphs indicated that network and subnetwork organization is highly variable from subject to subject, with only an average of 20% similarity of subnetworks. Under our second aim, we found that each subject's own modular network organization was reasonably stable over the 8-week period. The extent of DMN stability was 36% and the Salience networks' stability was 39%. There were no significant differences in MDD vs Control stability over time. Under our third aim, when we classified patients into tertiles representing differing degrees of stability versus flexibility (from "unstable" through "flexible" to "stable") we observed that patients with the most normative "flexible" stability in the Salience network had the greatest improvement in anhedonia symptoms ( $\beta = 1.3$ ,  $p = 0.0047$ ).

#### CONCLUSION

Modularity analysis of individually-constructed graphs offers a powerful tool for characterizing inter-subject variability in resting network organization and the extent of flexibility in such organization over time. Our findings suggest that commonly prescribed antidepressants may particularly benefit the anhedonia symptoms of patients with a normatively flexible organization of Salience subnetworks.

#### PRIMARY PRESENTER

Brooke R. Staveland

#### STATUS

Student – Undergraduate

#### AUTHORS

Brooke R. Staveland

Andrea Goldstein-Piekarski

Tali M. Ball

Zoe Samara

Mayuresh S. Korgaonkar

Leanne M. Williams

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

Leanne M. Williams



## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

### Secondary Traumatic Stress and Adjustment in Spouses of Injured Service Members

#### BACKGROUND

Upon return from deployment, injured service members and their spouses encounter unique emotional and physical challenges and obstacles. Injury of service members can affect family fitness by influencing secondary traumatic stress (STS) experience among the service members' spouses. Galovski and Lyons (2003) define STS as "any transmission of distress from someone who experienced a trauma to those around the traumatized individual." Crow, Reisbig, and Hamilton (2009), using a sample of 45 couples, identified a correlation between trauma symptoms in the service member and secondary traumatic stress symptoms in the partner. Bjornestad, Schweinle, and Elhai (2014) used the PCL-M to determine the prevalence of secondary traumatic stress in military spouses, and found a positive correlation between a service member's PCL score and the spouse's secondary traumatic stress score. The present study determines the relationship exists between secondary traumatic stress and couples adjustment.

#### HYPOTHESIS

Couples adjustment is negatively associated with spouses' secondary traumatic stress in couples comprised of an injured service member and a spouse.

#### METHODS

Participants were spouses of injured U.S. military service members (N=24). For the purposes of this study, an injured service member was defined as someone who lost one or more limbs during deployment. All service members were male, and all spouses were female. The measures used in this study were the Dyadic Adjustment Scale (DAS-7) and the PTSD Checklist (PCL-C).

#### RESULTS

When using the raw PCL scores, findings did not indicate a significant results, but did indicate a positive correlation ( $r=.332$ ) between PCL and DAS-7 scores. When using the PCL cutoff scores (PCL scores of less than 30 indicative of no STS, PCL scores greater than 30 indicative of presence of STS), however, the Pearson Correlation indicated a significant positive correlation between couples adjustment and STS symptoms in spouses of injured service members (.803,  $p<.01$ ).

#### DISCUSSION

Preliminary analyses did not support the hypothesis that couples adjustment would be negatively correlated with spouses' experience of STS. Rather, results indicated a positive correlation between couples adjustment and spouses' experience of STS. Several mediating variables could have accounted for the results of the study. In more satisfied couples, the military spouse may share more about his experiences during deployment, which may account for greater symptom severity among spouses. Additionally, perceived severity of the military spouses' injury may influence wives' experiences of STS symptoms. Future studies with greater sample sizes will determine whether a positive correlation exists between couples adjustment and experiences of STS symptoms by the non-military spouse.

#### PRIMARY PRESENTER

Margaret Talbot

#### STATUS

Student – Undergraduate

#### CO-PRESENTER

Andrea Calderon

#### AUTHORS

Margaret Talbot

Andrea Calderon

Matthew Allen

Allison Bond

Christine Leonhardt

Paul Bartone

Stephen Bowles

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

Stephen Bowles



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Differentiation-Dependent Antiviral Capacities of Amphibian (*Xenopus Laevis*) Macrophages

Colony stimulating factor-1 (CSF-1) is the principal macrophage (M $\phi$ ) growth factor that is indispensable for macrophage survival, proliferation and differentiation. CSF-1 binds to colony stimulating factor-1 receptor (CSF-1R), expressed on macrophage-lineage committed precursor cells and derivative populations. Recently, interleukine-34 (IL-34) has been identified as an alternate CSF-1R ligand and in *Xenopus laevis* this cytokine gives rise to morphologically and functionally distinct M $\phi$ s to those derived by CSF-1. Notably, while the *X. laevis* bone marrow-derived, CSF-1-differentiated M $\phi$ s are highly susceptible to the emerging Frog Virus 3 (FV3) ranavirus, IL-34 derived M $\phi$ s are highly resistant to this pathogen. Since antiviral interferon (IFN) cytokines are integral to vertebrate antiviral immunity, we examined the expression of these in CSF-1 and IL-34 M $\phi$ s, to account for their differences in antiviral activity. IL-34 M $\phi$ s showed robust expression of several members of these antiviral cytokine gene families along with their respective receptors. In contrast, CSF-1 M $\phi$ s exhibit modest IFN ligand and cognate receptor gene expression, presumably accounting for their less effective antiviral capacities. Cellular resistance to viral replication is controlled by a plethora of mechanisms, collectively coined restriction factors. Interestingly, IL-34 M $\phi$ s possessed significantly greater expression of select restriction factors than CSF-1 M $\phi$ s. Finally, we observed that IL-34 M $\phi$ -conditioned supernatants conferred partial anti-FV3 protection to the *X. laevis* A6 kidney cell line. This study elucidates the mechanisms facilitating the cogent anti-FV3 capacities of IL-34 M $\phi$ s in comparison to CSF-1 derived M $\phi$ s.

---

#### PRIMARY PRESENTER

---

Amulya Yaparla

---

#### STATUS

---

Student – Graduate

---

#### AUTHORS

---

Amulya Yaparla

Leon Grayfer

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Leon Grayfer



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Review of Current Immunologic Therapies for Hidradenitis Suppurativa

Hidradenitis suppurativa (HS) is a chronic, recurrent, inflammatory disease of apocrine gland-bearing skin which affects approximately 1-4% of the population. Approximately one third of diagnosed patients report a family history. HS is disproportionately found amongst women and African Americans. Obesity and smoking are risk factors. HS is also significantly associated with an increased presence and new-onset of inflammatory bowel disease (IBD) which includes both Crohn's disease (CD) and ulcerative colitis (UC). There is a strong association between HS and risk of stroke, myocardial infarction, cardiovascular-associated death, and major adverse cardiovascular events (MACEs). The disease has a significant impact on the patient's quality of life. Non-curative HS surgeries are a significant financial burden to patients. Pathogenesis of HS is poorly understood and host innate or adaptive immune response, defective keratinocyte function, and the microbial environment in the hair follicle and apocrine gland have all been postulated to play a role in disease activity. TNF inhibitors as well as antibiotics have been shown to be efficacious in treating HS. There is an unmet need to explore further pathways that drive disease activity in HS with a view to identifying novel therapies and biomarkers of disease activity and prognosis.

---

#### PRIMARY PRESENTER

---

Nadia Zaman

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHORS

---

Nadia Zaman

Sean McNish

Faye N. Hunt

Victoria K. Shanmugam

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

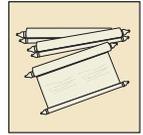
---

Victoria K. Shanmugam

---

# HUMANITIES

---



---

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

## Gilded Chivalry and Bygone Times: The Field of the Cloth of Gold in Memory Past and Present

On June 7th, 1520, England's premier Renaissance king, Henry VIII met with one of his chief rivals, Francis I, king of France at Calais in the north of modern day France. They met to secure an alliance for a European peace during this event, which would come to be known as the Field of the Cloth of Gold. The event has been documented extensively in both primary and secondary sources of different mediums, and remains one of the most momentous diplomatic and cultural displays of the early modern period.

But what are the cultural origins and legacies of this great event? Material culture composes one of the key foundations of the event's grandeur, and it has often gone under-explored from a theoretical standpoint by political historians. Though both contemporary and historical chroniclers of the event have described the event's planning and attributes of material culture, this paper draws upon and analyzes diverse historical precedents for as well as results of the event from a cultural and artistic standpoint. What did Henry VIII do differently from his historic counterparts in creating The Field of the Cloth of Gold and how did he influence the creation of its legacy? The Renaissance was an age of innovation, and the improvement of cultural events was no exception.

Though it would be an impossible task to compare all instances of material and court culture of the event in conjunction with Henry VIII's propagandistic programs, a periodization with other events along with a situation of the Field of the Cloth of Gold within the context of the combined lenses of performance theory and historical memory reconstruction allowed me to gain the most insight as to the impact of the written and visual sources I used throughout the paper. I explore common Tudor event schemes laid out by prominent historians. That means looking at the commonalities between the royal events of Henry VIII as well as his predecessor Henry VII, the first Tudor monarch as well as the events of other monarchs before and after. This methodology along with the lenses mentioned above allowed me to determine the ephemeral and lasting impressions of the Field of the Cloth of Gold and the intentions of Henry VIII within a wider historical narrative surrounding pageantry.

---

**PRIMARY PRESENTER**

---

Joseph Albanese

---

**STATUS**

---

Student – Undergraduate

---

**AUTHOR**

---

Joseph Albanese

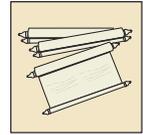
---

**RESEARCH MENTOR/  
DEPARTMENT CHAIR**

---

Suzanne Miller

Barbara von Barghahn



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### The Relationship Between Depression, Parenting Self-Efficacy, and Stress in Low-Income Mothers

Research focusing on White, middle-class parents has found that having low parental self-efficacy (PSE) is a risk factor for maternal depression (Weaver et al., 2008; O'Neil et al., 2009), whereas having high PSE is associated with lower parental stress (Raikes & Thompson, 2005). Furthermore, women with depressed mood and high stress reported lower PSE (Fox & Gelfand, 1994). The present study investigates the relationships between PSE, parental stress, and depression within a sample of low-income, ethnic minority mothers, which has not been examined in extant research. First, we hypothesized that PSE would be inversely related to depression and parental stress. Second, we hypothesized that parental stress would mediate the association between PSE and depression.

Participants were 71 African American/Black (78.9%) and Hispanic/Latino (15.5%) low-income mothers ( $M$  age = 29.96,  $SD$  = 8.04) of children ages 6 months to 11 years old ( $M$  = 5.43,  $SD$  = 3.31). Mothers completed face-to-face interviews, which included the following measures: a modified version of the Parental Self-efficacy Measuring Instrument (Harty, 2009;  $\alpha$  = 0.82), the Parental Stress Scale (Berry & Jones, 1995;  $\alpha$  = 0.80), and the Center for Epidemiologic Studies Depression (Radloff, 1977;  $\alpha$  = 0.90) scale.

As hypothesized, Pearson correlations indicated that PSE was significantly negatively correlated with parental stress ( $r$  = -.35,  $p$  < 0.01) and depressive symptoms ( $r$  = -.29,  $p$  < 0.05). Baron and Kenny's (1986) guidelines were used to investigate the mediation hypothesis. Regressions indicated that depressive symptoms were significantly associated with PSE ( $b$  = -.29;  $p$  < 0.05) and parental stress ( $b$  = .40;  $p$  < 0.01); and parental stress was significantly associated with PSE ( $b$  = -.35;  $p$  < 0.01). Supporting the presence of mediation, the association between depressive symptoms and PSE became non-significant when parental stress was accounted for in the model ( $b$  = -.18, ns), whereas the association between parental stress and PSE remained significant ( $b$  = -.28;  $p$  < 0.05).

Although this research is cross-sectional and causation cannot be inferred, the bivariate findings are consistent with previous studies: that parental self-efficacy may contribute to maternal depression, and that higher levels of self-efficacy may lead to lower stress. Mediation results suggest that interventions targeting coping skills to reduce parenting stress and skills training to increase parenting confidence in low-income populations may reduce maternal depression. Future research could examine how additional variables, such as child temperament and social support, might explain variation in PSE across income and ethnic groups.

---

#### PRIMARY PRESENTER

---

Jessica Allen

---

#### STATUS

---

Student – Undergraduate

---

#### CO-PRESENTER

---

Samuel Swisher

---

#### AUTHORS

---

Jessica Allen

Alyssa Poblete

Samuel Swisher

Christina Gee

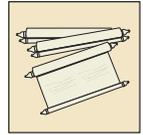
Sun Young Hwang

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Christina Gee



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Functional Morphology of *Australopithecus Afarensis* Foot: Evidence from the Fourth Metatarsal

*Australopithecus afarensis*, a ~4-3 million-years-old hominin (i.e., the human clade), exhibits a complex skeletal anatomy combining 'ape-like' and 'human-like' morphologies. Key features (e.g., pelvis configuration, femoral bicondylar angle, foot) unambiguously indicate that this hominin was—at least partially—adapted for terrestrial bipedalism, the 'hallmark' of humanity. However, although the anklebones and metatarsals exhibit human-like portions indicating striding bipedalism, yet the pedal phalanges are relatively long and curved, resembling African apes, and are seen as arboreal locomotor adaptations (improving grasping abilities). In 2000, a complete ~3.2 million-year-old, *A. afarensis* fourth metatarsal (mt4; with the accession number: AL 333-160) was recovered in Hadar, Ethiopia. Distinctive modern human features on this metatarsal (e.g., torsion, base morphology) indicate 'the *A. afarensis* foot was functionally like that of modern humans', supporting the view that this fossil hominin 'was a committed terrestrial biped' (Ward et al., 2011). Building on this work, the objectives of this study are to: (1) Use new approaches in 3D digitization to measure key functionally-related morphological features of AL 333-160 in a larger sample of apes and humans than in the original study (an increase of 75 specimens); in order to (2) determine whether or not *A. afarensis* exhibited a modern human-like type of bipedalism. Specifically, quantifying the following features associated to modern human-like striding bipedalism: the torsion of the mt4 (related to the possession of a transverse arch), the presence or lack of the lateral cuneiform articular surface (providing a more rigid mid-foot, aiding in propulsion in modern humans as compared to apes and fossil hominins), and the proportions of the proximal articular surface (deepening the dorsoplantar surface, which restricts dorsiflexion and plantar-flexion). Preliminary results indicate torsion of the *A. afarensis* mt4 falls within modern human variation, meanwhile overlapping with the range of apes (particularly gorillas), which was previously unnoticed. Additionally, the lateral cuneiform articular surface varies in modern humans, and is seen in some apes, and therefore cannot be relied upon when assessing the functional morphology of *A. afarensis*' mt4. Finally, the base proportions were found to be relatively taller than wider, exclusively within the modern human range.

The results of this study indicate that, currently, the hypothesis that *A. afarensis* exhibited a type of terrestrial bipedalism identical to that of modern humans cannot be supported, and highlights the complexity of inferring function from fossil morphologies.

---

#### PRIMARY PRESENTER

---

Alisha Anaya

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHOR

---

Alisha Anaya

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

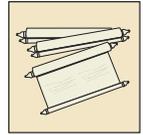
---

Sergio Almécija

---

# HUMANITIES

---



---

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

## Repetition, Variation, and the Multiple: How Sarah Bernhardt Achieved Enduring Celebrity Status

Whether it be through words or otherwise, even the most effective communicators do not always enjoy enduring celebrity. Communicating well, communicating deeply and communicating with emotion are important, but what transforms a one-time great performance into enduring celebrity? In an investigation of the intersection between communication and celebrity, this research looks to a woman who has been called the most prominent actress of the entire nineteenth century as well as the greatest actress who ever lived—Sarah Bernhardt. This research asserts that Sarah Bernhardt’s success in her own enduring celebrity can be credited to a trilogy of communication tactics: repetition, variation, and the multiple. These tactics, coupled with abject authenticity, take communication to a higher level. Sarah Bernhardt mastered the art of communication, leveraging the tools of repetition, variation, and the multiple for nearly three quarters of a century causing her celebrity status to survive almost another hundred years past her death and to endure for centuries to come. While our most common modes and mediums of communication have evolved since the nineteenth century, strong and fascinating parallels remain between the magnetism and tactics of communication used by Bernhardt and those of contemporary celebrities.

---

**PRIMARY PRESENTER**

---

Julia Barrett

---

**STATUS**

---

Student – Undergraduate

---

**AUTHOR**

---

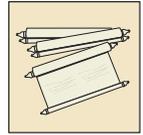
Julia Barrett

---

**RESEARCH MENTOR/  
DEPARTMENT CHAIR**

---

Mary Buckley



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### A Preliminary Study Using Novel Methods to Quantify Preauricular Sulcus Morphology

The preauricular sulcus is a sensitive indicator of parturition in female pelvis and is often utilized in forensic studies. However, some male pelvis also display a groove in the preauricular region, confounding the usefulness of this as a sex-determinant trait. A study by Bruzek (*Am J Phys Anthropol*, 2002) proposed that a 'true' female preauricular sulcus must have a distinct border and have at least two deeper bony pits contained within the sulcus. The aims of this preliminary study are to quantify (1) what percentage of female pelvis display Bruzek's 'true' female preauricular sulcus morphology and (2) the depth of the pits contained in the sulcus.

This was investigated by examination of female hipbones (os coxae) from a database of high-resolution laser scans. The sample included females from Sudan and North America (native and modern populations). In these the preauricular region was assessed visually to evaluate whether a 'true' preauricular sulcus was present, following the criteria outlined by Bruzek. Within a digital metrology software, the preauricular sulcus was isolated and set a best-fit plane to the preauricular region. The depth of the pits contained within was calculated relative to the best-fit plane and assessed as both an absolute value and scaled (relative to acetabulum diameter).

Only a small percentage (~8%) of the females in our sample displayed the 'true' preauricular sulcus morphology described by Bruzek. Although obstetric history was not available for this sample, it is likely that a larger percentage of these women had given birth during their lifetime, and suggests the Bruzek criteria is conservative in identifying females from osteological remains. Interestingly, the hipbones identified as having the 'true' preauricular sulcus morphology also had substantially deeper pits (absolute and scaled values) than the females that did not meet the strict criteria. The females that did not meet the Bruzek criteria had pits that were ~1.0 mm deep on average, whereas the pits contained within a 'true' preauricular sulcus were 2.3-3.8 mm deep. This study provides new data relevant for diagnosing female sex and parturition history in osteological remains, and may provide new criteria for diagnosing female sex related to depth of the pits in the preauricular sulcus.

---

#### PRIMARY PRESENTER

---

Eleanor Cordiner

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHORS

---

Eleanor Cordiner

Ashley Hammond

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

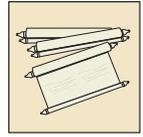
---

Ashley Hammond

---

# HUMANITIES

---



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Establishing Agency Within Contemporary Tamil Society: An Examination of Love, Tradition and Kinship Among Intersex and Thirunangai Communities

The purpose of my research is to explore how trans and intersex communities in Tamil Nadu use and reinvent logics surrounding kin relationships to indigenize their identities and activism. The major questions guiding this research pertain to the broader notion of constructing culture and identity, namely who decides what Tamil culture is. Furthermore, using anthropologist Naisargi Dave's (2012) notion of indigenizing queer identities to make them more palatable for local contexts, I want to explore what the process of indigenization looks like within trans and intersex communities. I assert three major claims based on the findings of my research: (1) traditional ideas of Tamil kinship become effective mechanisms for subverting the Westernization of the broader trans and intersex activism taking place in India; (2) relationships to an active kinship network become necessary for trans and intersex Tamilians to attain upward social mobility and status in the public sphere; and (3) larger constructs of kinship used in everyday life assert a claim and preserve a connection to Indian identity for members of trans and intersex communities in Tamil Nadu. To begin answering some of these questions and further my argument, I will be interrogating topics of romantic love, the kinship networks of the *jamath* system, and the intricacies of biological kinship ties as represented in both published written narratives, online stories, and data collected in interviews. In doing so, I aim to determine what trans and intersex Tamil communities classify as distinctly Tamil as well as where and how they stake a claim in defining Tamil culture and tradition.

---

#### PRIMARY PRESENTER

---

Lauren Danielowski

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHOR

---

Lauren Danielowski

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

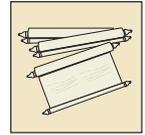
---

Aaron Theodore Samuel

---

# HUMANITIES

---



---

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

## Gladiators and Enemies: How Art Depicted the Real and Imagined Concept of Control In Imperial Rome

Ancient Rome was a society permeated with warfare and violence, the remnants of which are found in triumphal arches, war monuments, and columns. The expansion of the Roman Empire brought barbarian captives into the city of Rome who were often forced to participate in gladiatorial games. These games consumed the public interest and became more popular and extravagant throughout the imperial period. Roman images of both war and gladiatorial games represent an enemy's glorified and ritualized submission to Rome, either by being defeated in battle or yielding to the sponsor. This study compares public, imperial depictions of enemies defeated in war with privately-commissioned representations of gladiators in multiple media of Roman art (reliefs, mosaics, and ceramics). Iconographic features compared included posture and gesture, facial expression, and clothing. The style, material, and function of the works were also considered. From Augustus to Constantine, Roman concepts of control and submission change and become more or less realistic depending on the nature of the enemy and the stability of the empire: war imagery represents the literal conquest of Rome in which enemies lose their humanity, and over time the Roman victory becomes more gruesome; however images of gladiators remain relatively static and portray respect for the dying. Gladiatorial games represent the conquest of Rome replayed in the arena, because many gladiators were prisoners of war, but they also depict the cultural conquest of Rome as the empire expanded. The games represent Roman virtues and power over nature. Images of gladiators provide the viewer with a sense of control because in this context, the "other" will always be powerless, and the sponsor and the crowd rule combatants' fate based on how well they fulfilled Roman virtues in the arena. Both of these subjects allow the viewer to feel a strong sense of control over "the other," but structure this control in different ways. These findings support literary and archaeological theories regarding the role of gladiatorial games in Roman society and make new connections between how public and private art function together.

---

**PRIMARY PRESENTER**

Meredith Davis

---

**STATUS**

Student – Undergraduate

---

**AUTHOR**

Meredith Davis

---

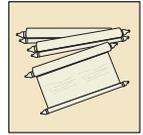
**RESEARCH MENTOR/  
DEPARTMENT CHAIR**

Elise Friedland

---

# HUMANITIES

---



---

## ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS

---

### Populism, Paternalism, and the Catholic Church in Latin America: A Dangerous Combination for Democracies

In this paper, I hope to examine the connections between Latin American populism's authoritarian and paternalistic tendencies through the vehicle of the Catholic Church. In order to do this, an analysis of the conceptualization of the role of "the state," and how its definitions often stem from the construct of the traditional patriarchal family is necessary. While it is difficult to compare a phenomenon as complex and controversial as populism to an institution as old and far-reaching as the Catholic Church, there does exist a shared intellectual ground between the two, as well as between Catholicism and paternalism. Paternalistic policies have been used by Latin American governments for centuries, but the way in which populists are paternalistic is a distinction worth making when it comes to populists' precarious relationship with democracy. Charismatic populist leaders often represent father or priest-like figures, which in turn constructs the people they claim to represent as child-like in their potential needs or interests. The example of José María Velasco Ibarra embodies the connection between populism, paternalism, and Catholicism very well, and Juan and Eva Perón exemplify the family-based style of politics and state authority. I will then discuss how these leaders' particular paternalistic tendencies are dangerous for democracy in a few ways. Although populism's ability to galvanize new forms of political participation is significant at a time when formal political participation is in decline, in unconsolidated democracies such as those in Latin America, populism may erode democratic institutions and usher in competitive authoritarian regimes. In this sense, there is a schism between populist governments which are paternalistic and those that are not: the latter have been better able to operate within the confines of democracy, while the former can edge into authoritarian territory for the sake of "protecting the people."

---

#### PRIMARY PRESENTER

---

Eleanor Dickinson

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHOR

---

Eleanor Dickinson

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

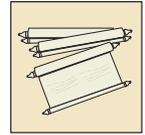
---

Michael McCarthy

---

# HUMANITIES

---



---

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

## Drag Kids: How Trans Adults Are Nurturing Their Inner (Trans) Child

With an increase in the visibility of transgender adults and even transgender kids and teens, I am left wondering about those trans individuals who were closeted until adulthood—or at least until the age of puberty and beyond. Specifically, I seek to prompt erotic and thought-provoking discussion on the following questions: When American childhood is so heavily impacted by binary, cisnormative, and heteronormative structures, what happens when that child is trans and then grows up, eventually comes out as trans, and thus never got the opportunity to experience childhood as their *authentic selves*? How is lack of education, resources, and support detrimental to trans kids who then become trans adults? If the inner child of a trans adult is deprived, how do we nurture that deprived *inner (trans) child*? How do we make up for, mourn, and come to terms with, lost time? Through conducting a series of interviews with transgender and gender non-binary adults and through engaging with relevant theory and scholarship, I explore the reasons why trans adults often feel that they were denied or deprived of what I coin *authentic childhood*. Further, this paper identifies the ways in which these adults try to reconcile their cisnormative, heteronormative, binary childhood with their queer, trans adulthood. Each interviewed subject admitted to feeling deprived of the childhood that they should have been able to live had they been given the opportunities and education necessary to live as a *consciously transgender* child. Specifically, I utilize examples from my interview subjects to demonstrate the ways in which transgender adults are attempting to relive certain aspects of their childhood as adults, thus engaging with *performative childhood* as a way to rectify conflicting identities of *child* and *trans*. By engaging with the intersection of transness and age outside of traditional binaries—cis/trans, child/adult—we can come to a better understanding of what transgender childhood is and to better understand the needs of the inner child of transgender adults. Through exploring these questions through storytelling and scholarship, we can better understand this phenomenon experienced in trans adulthood and also gain a more in-depth understanding of the ways in which we are failing trans youth.

---

**PRIMARY PRESENTER**

Erika Feinman

---

**STATUS**

Student – Undergraduate

---

**AUTHOR**

Erika Feinman

---

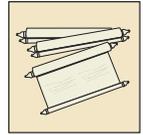
**RESEARCH MENTOR/  
DEPARTMENT CHAIR**

Cynthia Deitch

---

# HUMANITIES

---



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### That's Just the Way It Is: Symbolic Violence in a Seemingly Post-Racial America

How ignorant are we to the seemingly small yet exceedingly impactful moments, practices, and social customs that contribute to a long legacy of oppressing others? Comments and trends that seem so normal and harmless to us might speak volumes to other communities and individuals whose struggle, while potentially downplayed over the course of history, still persists in more subtle and internalized ways. Although these seemingly small-scale interactions involving varying levels of bigotry, intolerance, or mere ignorance can be expressed without physical violence, they correspond to and perpetuate a legacy that developed as a result of institutions of physical violence against marginalized communities and identities. The threat of physical violence and suppression lives on through the concept of symbolic violence, which is described by Pierre Bourdieu and Loïc Wacquant as violence which "accomplishes itself through an act of cognition and of misrecognition that lays beyond-or beneath-the controls of consciousness and will" in *An Invitation to Reflexive Sociology*.

So how does this function at GW and in Washington, DC? Without an understanding of how this concept functions in our society, we cannot effectively make strides to undo symbolic violence and racial biases that influence it. Through conducting community based research by interviewing GW students about their experiences at a Predominantly White Institution, collecting and analyzing perspectives on social media, and synthesizing already existing research on racial violence in America, my work will highlight the experiences of women of color specifically in the current climate. Focusing on both violence within and external of equal rights and social justice movements, I hope to show the intricacies of intersectionality and how much work is left in understanding symbolic violence, and acknowledging the impetus to create change on campus and in the world.

---

#### PRIMARY PRESENTER

---

Negar Esfandiari

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHOR

---

Negar Esfandiari

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

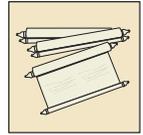
---

Cynthia Deitch

---

# HUMANITIES

---



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### A History of the Washington, D.C. Society of the Archaeological Institute of America

The Washington D.C. Society of the Archaeological Institute of America (AIA) was founded in 1895 as the tenth local society of North America's oldest and largest archaeological organization. The AIA itself was founded in 1879 to promote fieldwork, establish educational institutes, and inform the public about world archaeology. To date, there is no written history of the D.C. Society of the AIA, although the society was a major player in the national AIA, acting as publisher of one of the organization's earliest magazines, *Art and Archaeology*. This project investigates and compiles a history of the D.C. Society through its archives, publications, activities, and the contributions of past and previous members. The archives of the national AIA in Boston also contain material that places the D.C. Society within the context of the national organization. This study will demonstrate that from its beginning the D.C. Society was an influential group of archaeologists, educators, politicians, and other professionals. It often undertook innovative ventures in North America and Europe, including sponsoring excavations in New Mexico and Carthage. In addition to publishing the AIA's magazine, *Art and Archaeology*, meant for amateur members and the interested public, the society facilitated the procurement of a Congressional Charter which incorporated the national organization, making it unique among professional organizations. The D.C. Society also has early and significant connections to The George Washington University. GW's own Dr. Mitchell Carroll, a professor from 1899-1925, was instrumental in re-establishing and running the D.C. Society, which had folded between 1897 and 1902. Carroll was instrumental in publishing *Art and Archaeology* and served as the general secretary of the national AIA from 1908-1918. From all of this, Carroll—and his wife Caroline, who assumed many of his duties upon Carroll's early death in 1925—proved to be a significant figure in the early study of archaeology in the United States. Though the D.C. Society seceded from the national AIA from 1932 over tensions surrounding the magazine, it was re-affiliated in 1948 and has flourished, continuing to contribute to the national AIA and the field of archaeology in America. This project provides a history of this influential local Society of the AIA and invites further research into the D.C. Society and its contributions to the pursuit of world archaeology in the U.S.

---

#### PRIMARY PRESENTER

---

Allison Gartrell

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHOR

---

Allison Gartrell

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

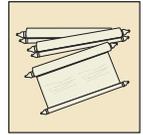
---

Elise Friedland

---

# HUMANITIES

---



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### *Hexentanz*: Economic Turmoil, Democratization, and Expressionism Embodied

At the turn of the twentieth century, the world was in the midst of a major transitional period. Democratization and liberalization were occurring at rapid rates, and with these changes came significant political, economic, and social consequences. These changes were especially distinct in Germany, where the process of democratization was particularly swift with the Kaiser's abdication and the subsequent establishment of the Weimar Republic. Though the Republic seemed faultless in theory, it was in reality a very weak system, prone to stagnation and ineffectiveness. In addition to the tumultuous political climate, the economic situation was terrible, plagued by hyperinflation and extreme recession. Discontent was building, and tension was brewing. In response, many people turned to art as a method of expressing their frustrations, and existing artists turned to new, more expressive methods in response to the changes they observed in the world around them. This was the beginning of the era of German Expressionism.

One of the world's most noteworthy and influential Expressionists was Mary Wigman, the dancer, teacher, artist, and performer. This research performs a close analysis of one of her most famous pieces, *Hexentanz*, or *Witch Dance* (1929), in the context of the critical political, social, and economic issues of the time. It explores all elements of the historic performance, including her costume choices, spatial arrangements, and physical movement, and in doing so, uncovers the deep metaphorical meaning and political nature of the dance.

---

#### PRIMARY PRESENTER

---

Marlee Grant

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHOR

---

Marlee Grant

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

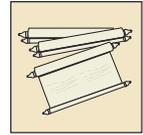
---

Mary Buckley

---

# HUMANITIES

---



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Likely Lies: A Statistical Analysis of the Prevalence of Modern Forgeries

#### OBJECTIVE

The authenticity of newly discovered artifacts is critically important. Scholars examine inscriptions for linguistic consistency, carbon dates, and intentions, among other factors. However, it can often be difficult to determine authenticity. This raises problems within the antiquities community. How ought media report on potentially forged artifacts? Are a few expert opinions enough to claim legitimacy? Which factors should be most heavily weighed when determining validity?

This paper seeks to establish an objective, statistical model for determining the authenticity of textual artifacts. A model is produced which analyzes qualities of an inscription, considers evidence against its legitimacy, and predicts the probability that it is forged.

#### METHODS

Data of sample size  $n=48$  case studies was compiled, 25 forgeries and 23 non-forgeries. Eight criteria were considered:

- 1) Date (C-14 or via textual analysis)
- 2) Linguistic inconsistency
- 3) Authenticity of script
- 4) Provenance
- 5) Location of purchase
- 6) Monetary motives for forgery
- 7) Social motives for forgery
- 8) Far-fetched or sensationalist content

Each criterion was represented as a binary variable, indicating evidence of forgery. A logit model was established, weighing each factor to produce the odds that an artifact was forged. The model output is the logarithm of the odds that an inscription is forged. The coefficients of the criteria are the factors by which they increased the odds.

#### RESULTS

A simple logit model with dependent variable "log odds of forgery" and independent variables "date", "language", "script", "provenance", "monetary motive", "social motive", and "sensationalism" was found significant. Five coefficients ("date", "script", "provenance", "social motive", "sensationalism") and the intercept were statistically significant ( $\alpha=.05$ ). The variables which increased the odds most were "social motive", "date" and "script", with "provenance" and "sensationalism" also producing large impacts. A confusion matrix to test the model found an 81% success rate within the data set. Four forgeries and five non-forgeries were predicted incorrectly, while thirty-nine inscriptions were correctly classified.

#### CONCLUSION

The model implies that poor script, incorrect date, and forger's motives are most heavily weighted in determining whether an artifact is legitimate. Poor provenance and sensational content also contribute. Each of these factors had a statistically significant impact on odds ( $\alpha=.05$ ).

This objective model could prevent media outlets from breaking incorrect information, or scholars from weighing some factors over more relevant evidence. It also demonstrates which aspects of an artifact are most significant and should therefore be examined preliminarily, potentially saving time and money for researchers and epigraphers.

#### PRIMARY PRESENTER

Katherine Jones

#### STATUS

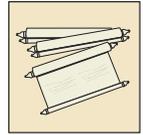
Student – Undergraduate

#### AUTHOR

Katherine Jones

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

Christopher Rollston



---

## ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS

---

### Trauma and Recovery in Post-Conflict Northern Uganda: An Analysis of the Effects of Mental Health on the Family

Trauma in Northern Uganda stems from the atrocities that occurred during the Lord's Resistance Army conflict. Because of this, thousands of victims were left traumatized by their experiences with disparities in aid to help them with their trauma. Utilizing the rural and urban areas in Kitgum and Gulu Municipality, this research seeks to understand how trauma presents itself in the Northern Uganda region and how it is defined by the population who treat it. This includes a list of disorders resulting from trauma and their symptoms. In addition, the efforts towards trauma healing and recovery are analyzed, including the different forms of treatment and how they affect the population. In this section, these forms are criticized and analyzed with their given challenges. With these challenges, the research takes an in-depth look at how trauma affects the family unit and what it means for Northern Uganda to develop a "trickling trauma" problem. Lastly, recommendations are given to try to mitigate the challenges that face trauma treatment today in Northern Uganda.

This qualitative research was conducted over the course of a month. During this time, interviews and focus groups were utilized in an attempt to better understand the topic of trauma in northern Uganda. These interviews were conducted amongst a population of NGO workers, local government, medical staff, and victims of trauma themselves. These respondents were specifically targeted for their relevance to trauma and its treatment. By snowball sampling, key informants were identified and then those key informants recommended other respondents that would aid in the researching of this topic. Each interview was recorded by taking notes and/or recorded by voice recorder with the consent of each respondent.

It was found that depression, anxiety, paranoia, and post-traumatic stress disorder were the most prevalent of the disorders that stem from trauma. Through these disorders many different demographics of people are affected and come are interconnected in the family unit. This means that a father's PTSD may result in gender-based violence which then traumatizes both the mother and the child, thus creating a new generation of trauma that was not directly affected by the war. Efforts towards treating these disorders range from psychosocial support, counseling, and medication prescriptions, each of these come with their own criticisms and recommendations are given in order to aid in mitigating the challenges they face.

---

#### PRIMARY PRESENTER

---

Shelby Logan

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHOR

---

Shelby Logan

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

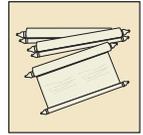
---

Elizabeth Saccoccio

---

# HUMANITIES

---



---

## SCHOOL OF MEDIA & PUBLIC AFFAIRS

---

### In This White House: Examining the Cynicism Paradigm of Political TV Dramas

The field of television studies has been changing and evolving since television was first created. While all forms of media can have a profound influence on individuals and communities, television in particular has been the subject of much analysis, debate, and discussion among academics and scholars. The academic conversation around television began shifting once media scholars began applying their findings to journalistic and political programming. As television continues to grow in terms of platforms and content, so must the literature surrounding the impact of television on a cultural and political scale. This paper traces the evolution of television studies, examining theories on cultivation, framing, and priming, in order to further explore the modern implications of political TV. This paper also includes a research design for studying political TV dramas (*The West Wing*, *House of Cards*, and *Madam Secretary*) that contain differing levels of idealism and optimism, and how that content can influence cynicism in young people.

---

#### PRIMARY PRESENTER

---

Haley Nolan

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHOR

---

Haley Nolan

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

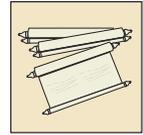
---

Kim Gross

---

# HUMANITIES

---



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Sacred Intentions: Religious Motivation for Economic Behavior

This project explores the fluid boundary between the religious and secular by examining the influence of intentionality on economic behavior. The project also asks us to consider a more humanist approach to economic theory that views the economic agent as concerned with more than just material gain. To this end I research the growth of BAPS, a transnational Hindu organization, and seek to explain it by taking into consideration the influence of the religious community's beliefs on the income and spending behavior of its members.

The rapid development of its religious infrastructure, in the form of temples, has not gone unnoticed in academic circles. However, no substantive research has been done to answer the question of why this religious community has been able to sustain this pace of development. I argue that the community's beliefs and prohibitions are conducive to higher returns on investment in human capital, largely education and lower conspicuous consumption. The higher income and extra savings allow them to contribute to the construction and maintenance of BAPS's religious infrastructure.

I examine the community's core sacred texts, which consists of the 'Vachanamrut' and the 'Swami ni Vaato.' The former is a series of discourses delivered by Swaminarayan, whom the community regards as the manifestation of God. The latter text consists of short sayings by Gunatitanand Swami, a disciple of Swaminarayan who BAPS considers the ideal devotee of God. Another text of import is the 'Shikshapatri', a book written by Swaminarayan that instructs followers on codes of conduct. In the two former texts I primarily looked to see how they delineate between religious actions and actions that fall outside of the religious realm. In the latter text I looked for how religiously prescribed rules and prohibitions influence consumption and savings.

The texts tell us that intentionality determines the religiosity or secularity of an act. The intent to please God functions to sacralize all action performed by a follower. Actions which fall outside of the boundaries of normative religious practice can be considered religious depending on the intent of the action's performer. Hence, investments in human capital such as education are encouraged to be viewed as a devotional act. The restrictions on certain forms of consumption such as alcohol among others, have the potential to enhance the investment in human capital. In addition, they allow the follower to find more ways to save earned income.

This project sheds light on the linkages between the values a religious community upholds and its physical development. It provides some direction to researching growth patterns of other contemporary religious communities both in their origin and the diaspora. In addition, the implications of the findings also call into question economic agent of neoclassical economic theory. We are asked to locate the economic agent in society where he or she is influenced by culture and religion.

---

#### PRIMARY PRESENTER

---

Sunny Patel

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHOR

---

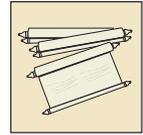
Sunny Patel

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Paul Duff



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### A Statistical Analysis of Rudolf Laban’s Dance Compositions

Despite a growing number of publications in recent years documenting the impact of the German choreographer, Rudolf Laban, on 20th century European dance theater, his contributions to the dance world have yet to be explored from a statistical perspective. The prevailing literature points to Laban’s lifelong battle with mental illness, spasmodic manic depression; his affiliation with the Nazi Socialist German Worker’s Party; and the sociopolitical breakthroughs of his contemporaries, artists Cezanne, Matisse, and Picasso and psychologist Sigmund Freud; as the foundations of his unique approach to dance and human movement, without acknowledging the fundamental role statistics played in the life and work of the mercurial choreographer. Works such as “Symmetry and Topology: Rudolf Laban’s Theory Building Tools” by movement specialist Carol-Lynne Moore and “Development of Laban’s Movement Ideas and Practices: Coexistence of Analysis and Synthesis” by dance scholar Vera Maletic touch upon the importance of geometrical and mathematical models in Laban’s theories of movement, but fail to address the branch of applied mathematics from which these models derive: statistics. To appreciate the depth of Laban’s contributions to the dance world, this paper will correlate the statistical principles and methods that underlie the construction of his compositional structures.

In this analysis, I focus specifically on statistics as a determinant of Laban’s success in the study and practice of dance and human movement. Statistics is defined as the “branch of mathematics dealing with the collection, analysis, interpretation, and presentation of masses of numerical data” (Merriam-Webster). Each of these components of statistics—collection, analysis, interpretation, and presentation—provide new avenues for understanding the choreographer’s career trajectory and life work. By analyzing the statistical techniques and research methods Laban implemented in these four areas, the explanation for the longevity of his movement theories, dances, notation system, and work efficiency studies will become clear. My dissection of Rudolf Laban’s work, “Crystal,” recreated for film by Laban’s former student and biographer, Dr. Valerie Preston-Dunlop, and Allison Curtis, a specialist in Choreology and faculty member at the Trinity Laban Conservatoire of Music and Dance in London, will provide further insight into how Laban was able to stage successful productions and develop his theories of movement, using only the statistical properties he abstracted from his studies of British factory workers.

---

#### PRIMARY PRESENTER

---

Kiara Robertson

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHOR

---

Kiara Robertson

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

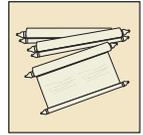
---

Mary Buckley

---

# HUMANITIES

---



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Black Reproductive Freedom: Contraceptive Counseling

Black women have an extensive history of their reproductive autonomy being systematically controlled through harmful health care practices. Today, research indicates that this social issue continues to persist as there is a salient disparity in the preferences that Black women look for in a contraceptive method versus what is being prescribed and recommended to them by their contraceptive counselors. Through semi structured qualitative interviews, this research seeks to understand the decision-making process of young Black women of the ages 18-24 regarding how they choose a contraceptive method. The study will specifically focus on the role that contraceptive counseling played in making contraceptive decisions. This study differs from majority of existing research by answering the research questions through the incorporation of voices from the marginalized group. Results and implications of this study will be discussed once completed.

---

#### PRIMARY PRESENTER

---

Charleene Smith

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHOR

---

Charleene Smith

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

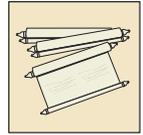
---

Emily Morrison

---

# HUMANITIES

---



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### George Washington and Commerce in 18th-Century Alexandria Through the Lens of Historical Archaeology

Through my research, I aim to investigate the question of how commerce developed in the port of Alexandria during the 18th century, particularly focusing on the trading practices of George Washington. This is an interdisciplinary investigation into the subject, through the utilization of both historical records and archaeological data. I by working with the Alexandria Archaeology Museum as well as the Mount Vernon Estate, the Society of the Cincinnati research library, and the Albert H. Small Collection I have accessed a variety of resources for my research, including documentary sources such as George Washington's orders and invoices from his agents in England, as well as advertisements for goods in local Alexandria newspapers. By accessing data from the archaeological record, such as the midden Mount Vernon excavated in 1995, I am able to compare the goods found against these documentary sources. This allows me to determine patterns of consumption during George Washington's life at Mount Vernon, and how they changed over time. My expectation is that over time, particularly after the period of the American Revolution, Washington will have imported fewer goods from England, relying more heavily on American-made goods as a show of patriotism and commitment to the prosperity of the new nation. Additionally, it leads to interesting conclusions about how Washington saw himself as a symbol of the new republic, and how connected that image was to his material goods. Washington, as the first President of the United States, is widely known for setting many precedents, and it is clear through his actions in that office that he wished to provide a strong example for the future. My research seeks to determine how this played into his habits of personal consumption and whether a change can be seen over the course of his life.

---

#### PRIMARY PRESENTER

---

Kathryn White

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHOR

---

Kathryn White

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Denver Brunsman

---

# INTERNATIONAL AFFAIRS

---



---

## ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS

---

### Does Higher Education Impact the Regional Unemployment Rate in Spain from 2001 to 2011?

This paper examines seventeen Spanish regions from 2001 to 2011 and how the differences in male versus female educational attainment explains Spain's regional unemployment rate. Using a panel regression, results indicate there is a lower unemployment rate across northern regions compared to southern regions in Spain. The results further provide evidence that women who complete tertiary education have a larger impact on regional unemployment rates than men. Overall this study concludes both men and women who complete tertiary education positively increase the regional unemployment rate. Lastly, this paper looks at the effects of the 2008 financial crisis which conclusively increased regional unemployment rates in Spain. Through the positive effects of men and women who complete tertiary education and the 2008 financial crisis, this study concludes that the labor market in Spain may be saturated. A growing labor force illustrates the availability of jobs for educated laborers may be low.

---

#### PRIMARY PRESENTER

---

Madeline Adelman

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHOR

---

Madeline Adelman

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Chao Wei

---

# INTERNATIONAL AFFAIRS

---



---

## ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS

---

### Protecting the Right to Life of the Internally Displaced: An Examination of Encampment and Its Effects on the Communities in Unyama and Koro Sub-Counties in Gulu District, Northern Uganda

This study examines the period of encampment in Northern Uganda, as related to the Lord's Resistance Army conflict. The objectives of this study include; to examine the process of displacement, to analyze whether displaced persons were accorded the right to security during the encampment period, to analyze the effects that encampment has had on communities during the return period, through present day, and to examine the ways in which various actors have attempted to address such effects.

This research was conducted over a four week period in Gulu District, Northern Uganda. A case study design was employed to examine the impacts of encampment on two particular communities in Unyama and Koro Sub-Counties. A total of 74 respondents were interacted with for the purpose of data collection. The primary methods used for data collection included interview, group interview, focus group discussion, and observation. For ethical consideration, this research was approved by a local review board, as well as the Ugandan National Council for Science and Technology.

The findings of this research determined that the policy of displacement issued by the government of Uganda was not made in the interest of civilian protection. Subsequently, during the encampment period, civilians were not accorded the right to physical, food, or educational security, due to the government's unwillingness to prioritize civilian protection. Since civilian property and lives were not protected during encampment, it has created negative impacts on civilians from the return period, through present day. Such impacts include poverty, dependency, and unemployment due to the loss of educational opportunities for many during encampment. Although government and non-governmental organizations have attempted to address some of these negative impacts, there continues to remain a significant amount of work to be done to ensure that civilians can engage in personal and economic development for the wellbeing of society as a whole. These issues must be addressed by the Government of Uganda in the near future, as such issues, if they remain unaddressed, have the potential to cause instability in Northern Uganda, as well as in the whole of Eastern Africa. The findings in this research indicate that, on an international scale, there continues to exist gaps in the international system regarding the protection of internally displaced persons and that the current, non-legally binding international document, the Guiding Principles on Internal Displacement, has not done enough to ensure the adequate protection of these persons.

---

#### PRIMARY PRESENTER

---

Ashley Alessandra

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHOR

---

Ashley Alessandra

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Martha Wandera Nalubega

---

# INTERNATIONAL AFFAIRS

---



---

## LAW SCHOOL

---

### Iran US Nuclear Negotiation: A Window Toward Trade Development After Partial Sanction Relief and US Election

Iran and the United States established their diplomatic relationships until the time that a group of Iranian students stormed the American Embassy, taking 52 American personnel as hostage. Ever since, the U.S.-Iranian relations have been generally hostile, and a wall of mistrust has overshadowed the bilateral relations. The U.S. Government, through Executive Orders issued by the President as well as congressional legislation, prohibited nearly all trade and investment with Iran by U.S. persons, but maintained broad authorizations and exceptions that allow for the sale of food, medicine, and medical devices by U.S. persons or from the United States to Iran. Whether the declaration of this argument “would eventually be ineffective and inconsequential” was deliberately threatening, or instead innocently zealous, advocacy is much less clear than the strength of Iran’s views on the question. This paper is an attempt to analyze Iran’s and United States’ strategies in the nuclear negotiations. It specifically analyzes the negotiation strategies and also how two countries established peace between themselves; emphasizes how the diplomats of two countries tried to have an agreement that will endure long and will result in future trades; and, assesses on which areas two countries can be dealing trades and how they can establish their trust. Moreover, this article addresses how Iran tried to prolong the negotiations while simultaneously working on its nuclear infrastructure broke the trust between two countries to the extent that the US started forcing Iran to zero enrichment. In addition, the strategies, strive, and patience that both party served created the path toward an economy and trade between them. This article also reviews how the relationship of these two countries was hostile in decades and how afterwards, the policies of the countries changed toward reformation, democracy and nuclear deal. It also pinpoints about the fact that how American hegemony was in consistent with what happened in the early stages of negotiations.

---

#### PRIMARY PRESENTER

---

Seyedeh Armaghan Azhar

---

#### STATUS

---

Student – Graduate

---

#### AUTHOR

---

Seyedeh Armaghan Azhar

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Charles H. Camp

---

# INTERNATIONAL AFFAIRS

---



---

## ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS

---

### Challenging Executive Foreign Policy: How Congress and Non-Governmental Organizations Redefined US Policy Towards South African Apartheid

Why did US foreign policy toward South African apartheid shift from “constructive engagement” to “punitive sanctions” between 1984 and 1986? Did the change flow from the efforts of the president or the executive branch of government? Or did it reflect a more complex interaction between the House and Senate and a variety of racially-sensitive non-governmental organizations? This study will trace the process of American foreign policy decision-making over the course of two years, and show how the influence of race brought about a fundamental reorientation in international affairs. Following a detailed chronology which parallels domestic and international pressures allows this research to analyze a continuum of events which enabled the introduction of economic sanctions into The United States’ South Africa Policy. This study focuses on how members of the Congressional Black Caucus, as well as members of the lobbyist group TransAfrica, were able to mobilize public opinion and political enterprise in order to override a Presidential Veto and pass the Comprehensive Anti-Apartheid Act.

Illustrating the core policy-making influences of grass-roots democracy and regular election cycles, this study will draw lessons for policy actors and suggest new directions for current policy actors. This analysis is of particular interest today as we have an executive with minimal experience in foreign policy, who has opposition along both party lines. An understanding of the extent of agency possessed by the legislative branch, gives an example of how to harness the balance of powers to strengthen foreign policy.

---

#### PRIMARY PRESENTER

---

Callie Galfas

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHOR

---

Callie Galfas

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Lori Gronich

---

# INTERNATIONAL AFFAIRS

---



---

ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS

---

## Why Do They Leave? The Status of Guatemalan Female Migrants Under International Law

Twenty years after the end of the country's 36-year long civil war, violence and impunity remain endemic in Guatemala, especially violence against women. In 2014 alone, 14,000 unaccompanied minors from Guatemala arrived in the United States, and had the fourth highest rate of female homicides in 2015. As a consequence of the violence, the number of migrants leaving Guatemala has risen in recent years. However, because migrants are fleeing both violence and poverty, these migrants are typically not classified as refugees under international law. Women are of particular concern, as they are both considerably vulnerable to violence in Guatemala, but also are due special protections under international law and U.S. refugee law. This study attempts to clarify the reasons why women emigrate from Guatemala by compiling qualitative interviews with experts, migrants' own stories, and relevant statistics. Analysis of these interviews and reports will yield a clearer understanding of motives of emigration, which will be evaluated in the context of prior U.S. Board of Immigration Appeals decisions. An international law perspective will be used in order to contribute to the discussion about which protections these migrants are or are not due. By considering the specific reasons why women choose to leave and the obligations under international humanitarian law and international human rights law, this project will add to a growing body of research on the laws of war and human rights in the specific Guatemalan context.

---

**PRIMARY PRESENTER**

---

Kaly Moot

---

**STATUS**

---

Student – Undergraduate

---

**AUTHOR**

---

Kaly Moot

---

**RESEARCH MENTOR/  
DEPARTMENT CHAIR**

---

Cynthia McClintock

---

# INTERNATIONAL AFFAIRS

---



---

## ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS

---

### How Shared Identities Impact Host-Refugee Relations: The Case of Burundian Refugees in Rwanda

Conflict, identity, and displacement have been common threads in Rwandan and Burundian histories since colonization. In 1994, the world watched as Hutu Power extremists systematically decimated the Tutsi population of Rwanda and just twenty years later, international news sources began watching Burundi crumble into a state of chaos following President Nkurunziza's announced intentions to remain in power. While scholars disagree on whether Burundi's current conflict is ethnic or political in origin, it is hard to ignore the significance of the socially constructed identities that have long characterized the two states. While the intricacies of identity formation within each has been explored in depth, both individually and comparatively, less has been done to understand how Rwandan and Burundian conceptions of identity, self, and belonging change once they have been forced to flee from their homeland due to conflict, and more importantly, how identity plays into displaced peoples' acceptance into host communities thereafter. As such, this study seeks to understand how the shared colonial, historical, cultural, migratory, ethnic, and linguistic identities of Rwandans and Burundians may impact the way they perceive one another and what that means for daily interactions, especially given the prevalence of Burundian refugees in Rwanda today. This project derived from previous research conducted by the presenter in Spring 2016, which found stark differences in how Rwandans and Burundians understand each other's ways of managing identity and their respective levels of social cohesion. In addition to interviews conducted in Spring 2016, this research project consisted of qualitative interviews conducted with individuals from three main groups located in Kigali in Winter 2016-17. They included representatives of organizations engaging with Burundian refugees, Rwandan citizens who have had personal experiences with Burundi or Burundians, and Burundian refugees themselves. In identifying response patterns in and across groups, the results shed light on the ways that Rwandans identify with or perceive Burundian refugees and on Burundians' feelings of belonging in Rwanda. Thereby promoting a new kind of dialogue pertaining to Rwandan-Burundian relations, focusing intentionally on the people affected by conflict and displacement, and contributing to broader scholarship on how to foster positive host-refugee relationships, in the Great Lakes region and elsewhere.

---

#### PRIMARY PRESENTER

---

Lacy Myrman

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHOR

---

Lacy Myrman

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Eric Kramon

---

# INTERNATIONAL AFFAIRS

---



---

## ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS

---

### After Raqqa: The Lasting Impact of the Daesh Cyber Caliphate

In recent years, the terrorist organization Daesh (also known as The Islamic State in Iraq and al-Sham or ISIS) infamously caught the attention of Western media for two seemingly opposing reasons. On one hand, Daesh is presented as an ominous global threat due to the tragic terror attacks committed and inspired by Daesh in Paris, Brussels, Orlando and many others. On the other hand, Daesh is presented as structurally failing as demonstrated through territorial defeats in Manbij, Fallujah and Dabiq against global coalition forces. From headlines, a contradictory message is portrayed that as Iraq and Syria are freed from Daesh, the rest of the world is increasingly in danger of attack. This paper investigates this counterintuitive phenomenon in three parts. In part one, this paper a) evaluates the number of Daesh affiliated attacks in the West over time b) evaluates the attacks' lethality and c) compares the figures to pre-existing data on Daesh territory lost over time. I conclude in part one that Daesh global attack "success" is not hindered from territorial loss. Part two seeks to explore the cause of this observation through a general analysis of the online presence of Daesh (also known as the Daesh Cyber Caliphate) and evolving Cyber Caliphate messaging strategies using primary source propaganda examples. Ultimately, I argue that Daesh is leaving an online footprint that will continue to inspire attacks and splinter groups even after the current leadership is defeated. I do not abandon this issue without offering solutions as part three makes policy suggestions for current countering violent extremism strategies to address future issues with combatting the Daesh Cyber Caliphate.

---

#### PRIMARY PRESENTER

---

Helen Powell

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHOR

---

Helen Powell

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Melani McAlister

---

# INTERNATIONAL AFFAIRS

---



---

ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS

---

## Indian Negotiation Behavior at the United Nations

This paper explores why India approaches development issues with multilateral negotiation strategies but approaches security issues with unilateral or hybrid negotiation strategies. India has regularly taken on a leadership role on development issues, actively serving as a facilitator and forming coalitions under the G77, managing the positions of over 130 diverse partners. This multilateral strategy has been particularly effective in India's negotiations on the 2030 Agenda and climate negotiations, where India spearheaded the establishment of the International Solar Alliance and the creation of indicators and national reviews on SDG progress. On security topics, however India has been much less consistent about multilateral strategies or coalition leadership. An analysis of Indian engagement at the Counter-Terrorism Committee under the auspices of the Security Council, as well as Indian negotiations on Security Council Reform, we observed India either unable or unwilling to organize and lead a coalition, or using a hybrid combination of lukewarm multilateralism along with unilateralism to advocate India's positions.

These actions represent significant departures from India's effective multilateral model in important ways. Three possible explanations for this departure could be: a) that India finds the costs of effective multilateralism on security to be higher than on development; b) that India has a great number of willing coalition partners on development issues, but not as many on security; c) the nature of security as a more politically tricky topic area, resulting in more gridlock and less cooperation; and d) the institutional division of India's Ministry of External Affairs, which divides India's UN approach into "UN Political" issues separately from "UN Economic and Social" issues, leads to the adoption of different strategies for security issues, which fall into "UN Political," and development issues, which fall into "UN Economic and Social". To explain motivations for these different strategies, I look at statements made by India at the United Nations on these topics. I will also interview Indian diplomats, particularly the First Secretaries and Counsellors who have negotiated on these issues, and will look at proposed draft resolutions by India and blocs that India leads.

---

**PRIMARY PRESENTER**

---

Aman Thakker

---

**STATUS**

---

Student – Undergraduate

---

**AUTHOR**

---

Aman Thakker

---

**RESEARCH MENTOR/  
DEPARTMENT CHAIR**

---

Martha Finnemore

---

# INTERNATIONAL AFFAIRS

---



---

ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS

---

## Counterterrorism Coordination in the EU

This analytical paper tests two hypotheses to explore how France and Belgium have coordinated their counterterrorism policies with the rest of the European Union. In the last two years, the European Union has fallen victim to many terrorist attacks, and EU member states have scrambled to find a way to combat them. This paper will look at how the European Union is fighting the current trend. The research hypothesis states that France and Belgium determine their counterterrorism policies based on domestic and national factors. The alternative hypothesis posits that international factors are pressuring EU member states to coordinate in order to prevent terrorism. To test these hypotheses, the paper looks at domestic factors in France and Belgium and actions taken by their domestic governments and by European Union institutions regarding terrorism, concentrating mainly at events since January 2015.

---

**PRIMARY PRESENTER**

---

Ellee Watson

---

**STATUS**

---

Student – Undergraduate

---

**AUTHOR**

---

Ellee Watson

---

**RESEARCH MENTOR/  
DEPARTMENT CHAIR**

---

Michael Sodaro

---

# INTERNATIONAL AFFAIRS

---



---

## ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS

---

### Migration in Choekhor Valley, Bhutan: Demographics, Dynamics, and Decision-Making

Even compared to its Asian neighbors, the small Himalayan nation of Bhutan is rapidly urbanizing as the historically rural, subsistence-based agricultural society converges on its urban centers. The Royal Government of Bhutan (RGoB) has addressed the demographic change with concern, implementing measures to develop rural areas in hope of curbing urban growth while citing anxieties about negative socio-economic and cultural changes. Despite its prevalence in dialogue, rural to urban migration is little studied, and resolution of the data available is coarse and does not address key considerations in decision-making, such as the push factors of migration. This mixed method, interview-based research focuses on Choekhor Valley, locale of the urban and political seat of Bumthang. Initial exploratory findings about migration in the valley show rural to urban migration to be a considerable population dynamic experienced by the majority of respondents and/or their immediate family. Factors such as education attainment, quality of life in the past, and land holdings are found to show preliminary correlations with migration. Reasons for migration are consistent with national findings, with most migrant respondents claiming that jobs, marriage, and studies prompted relocation. Evidence for push factors, with the environmental push factors emphasized in the research, is insufficient for conclusions, an absence of data attributed not to their nonexistence, but to cultural and research norms that emphasize positively-stated pull factors over the negatively-stated pull. Further research is called for to more precisely uncover the push factors generally and environmental push factors specifically within Choekhor Valley and greater-Bhutan using mixed method approach that supplement quantitative demographic data with oral histories to best understand the complex dynamics of migration in Bhutan.

---

#### PRIMARY PRESENTER

---

Helen Wilson

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHORS

---

Helen Wilson

Matt Branch

Nigel Anderson

Julia Cavicchi

Dominique Flaksberg

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Matt Branch

---

# INTERNATIONAL AFFAIRS

---



---

## ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS

---

### The Cost of U.S. Protectionism: Determining the Effects of Monitoring Chinese Takeovers of U.S. Firms on U.S. Firm Share Price Values

The Committee on Foreign Investment in the United States (CFIUS) was originally created by President Gerald Ford in 1975 to only analyze trends in incoming foreign investment. The committee's role has since evolved and expanded to act as a federal gatekeeper for incoming foreign investment and has the authority to allow or block any foreign acquisition or takeover of a U.S. company that is perceived as a threat to U.S. national security. During the last decade, China has come under increased examination by the U.S. government for its attempted takeovers of firms in sectors that the U.S. government has deemed as critical to national security. In addition, of the cases CFIUS reviews each year, Chinese cases are subject to the greatest scrutiny. This paper replicates and innovates on a previous economic study conducted by Kam-Ming Wan and Ka-Fu Wong that examines the economic impact of political barriers to a controversial Chinese cross-border acquisition of a U.S. firm. One successful CFIUS cases and one unsuccessful CFIUS cases are analyzed and compared and the paper attempts to draw conclusions that would further the discussion on the economic effects of Chinese cross-border acquisitions of U.S. firms.

---

#### PRIMARY PRESENTER

---

Cindy Zhang

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHOR

---

Cindy Zhang

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Robert Sutter



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Characterizing the Interaction of MID1 and Huntington's Disease mRNA to Gain Insight on How to Prevent Mutant Protein Production.

Huntington's disease is an incurable genetic disorder caused by protein aggregation in the brain, leading to symptoms such as dementia, involuntary movements and ultimately death. The disease is caused by the overproduction of the mutant huntingtin protein (mHTT), which contains more than 35 glutamine (Q) amino acid repeats at its N-terminus. In contrast, the normal huntingtin protein (HTT) contains approximately 18 Q. Typically, the mutant mRNA of mHTT with >35 CAG repeats is degraded prior to translation, but appears to be stabilized in Huntington's disease. The Midline-1 (MID1) protein functions to stabilize the mHTT mRNA, but the mechanism of stabilization is not known. My project focuses on characterizing the interaction between the varying domains of MID1 and the CAG repeats. Gel shift assay experiments revealed that all but one domain of MID1 interact with the CAG RNA repeats. These results suggest a possible mechanism by which MID1 might stabilize the mutant mRNA with the longer CAG repeat in comparison to the mRNA with the shorter CAG repeat. Preventing the translation the mHTT mRNA is considered the most effective approach for defeating Huntington's disease. Therefore, understanding the detailed structural mechanism of the MID1 domain interaction with the various lengths of the CAG RNA repeats will provide insight for disrupting this interaction and destabilizing the mHTT mRNA.

---

#### PRIMARY PRESENTER

---

Addie (Anood) Abdel Jawad

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHORS

---

Addie (Anood) Abdel Jawad

Michael Massiah

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Michael Massiah



---

## CORCORAN SCHOOL OF THE ARTS & DESIGN

---

### Hypertrophy of the Cypriniform Pharyngeal Jaw: Growth Patterns of Branchial Arches within Cypriniformes and their Relatives

In teleost fishes, the branchial arches form a highly modified feeding apparatus known as the pharyngeal jaws. Cypriniformes in particular have undergone further modifications to their feeding morphology. One such modification is the hypertrophy of the lower pharyngeal jaw, or fifth ceratobranchial. While in more basal teleosts the ceratobranchials decrease in size anterior to posterior, the cypriniform ceratobranchial 5 is often much larger than the preceding arches. How this hypertrophied fifth ceratobranchial develops throughout ontogeny in comparison to ceratobranchials 1-4 has not been carefully studied. To investigate the possible developmental mechanisms behind this modified morphology, we compare the ontogeny of a cypriniform pharyngeal jaw (*Danio rerio*) with the ontogeny of the pharyngeal jaws of more basal species (*Anchoa mitchilli* and *Brevoortia tyrannus*). Here we present comparative data from morphometric analyses of the ceratobranchial arches in larval to adult specimens of *D. rerio*, *A. mitchilli*, and *B. tyrannus*. We find that multiple heterochrony events, including sequence and rate of chondrogenesis, sequence and rate of ossification, and overall growth of the ceratobranchials, may contribute to the greatly hypertrophied ceratobranchial 5 in Cypriniformes. This data provides a glimpse at a few of the possible developmental mechanisms behind morphological innovations.

---

#### PRIMARY PRESENTER

---

Acacia Ackles

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHORS

---

Acacia Ackles

L. Patricia Hernandez

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

L. Patricia Hernandez



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### CAMSA: A Tool For Comparative Analysis and Merging of Scaffold Assemblies

Despite the recent progress in genome sequencing and assembly, many of the currently available assembled genomes come in a draft form. Such draft genomes consist of a large number of genomic fragments (scaffolds), whose positions and orientations along the genome are unknown. While there exists a number of methods for reconstruction of the genome from its scaffolds, utilizing various computational and wet-lab techniques, they often can produce only partial error-prone scaffold assemblies. It therefore becomes important to compare and merge scaffold assemblies produced by different methods, thus combining their advantages and highlighting present conflicts for further investigation. These tasks may be labor intensive if performed manually.

We present CAMSA - a tool for comparative analysis and merging of two or more given scaffold assemblies. The tool (i) creates an extensive report with several comparative quality metrics; (ii) constructs the most confident merged scaffold assembly; and (iii) provides an interactive framework for a visual comparative analysis of the given assemblies. Among the CAMSA features, only scaffold merging can be evaluated in comparison to existing methods. Namely, it resembles the functionality of assembly reconciliation tools, although their primary targets are somewhat different. Our evaluations show that CAMSA produces merged assemblies of comparable or better quality than existing assembly reconciliation tools while being the fastest in terms of the total running time.

---

#### PRIMARY PRESENTER

---

Sergey Aganezov

---

#### STATUS

---

Student – Graduate

---

#### AUTHORS

---

Sergey Aganezov

Max A. Alekseyev

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Max A. Alekseyev



---

## CORCORAN SCHOOL OF THE ARTS & DESIGN

---

### Catalytic Dehydrogenative Coupling of Amines

Amines and imines are two of most common motifs in active pharmaceuticals, but their traditional syntheses often require toxic alkyl halides and aldehydes. While alcohol-amine coupling reactions are now more common, reactions of exclusively amine partners reacting without oxidants are not known. In an effort to develop atom-economical methods for synthesis of imines and amines from more benign starting materials, we have developed a method for acceptorless dehydrogenative coupling of amines to selectively form imines and amines using low-cost heterogeneous catalysts. The catalysts consist of palladium and iron-doped layered double hydroxides, and have been characterized by an array of methods in an effort to elucidate structure-activity relationships and the catalytically active species. The selectivity of the reaction can be controlled by small changes to the catalyst and reaction conditions. The substrate scope and selectivity obtained for different substrates are explored, as are experiments to probe mechanism of this reaction. The recyclability of the catalysts is also discussed.

---

#### PRIMARY PRESENTER

---

Diana Ainembabazi

---

#### STATUS

---

Student – Graduate

---

#### AUTHORS

---

Diana Ainembabazi

Nicholas Tiedemann

Adelina Voutchkova

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Adelina Voutchkova



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Gene Expression of *Crossveinless C*, *Tenectin* and *Ecdysone-Induced Protein 74EF* in Testis is Associated with Sperm Length Phenotype

Sperm are the most diverse cell type in the animal kingdom and tend to evolve rapidly. The fruit fly *Drosophila* produces the longest sperm known, up to 5.8 cm and 20 times longer than the fly itself. Evolution of this extreme trait seems to be driven by sexual selection mediated by sperm competition and cryptic female choice, which can occur when females mate with multiple males and subsequently bias fertilization success of one male's sperm over another's through morphological, behavioral, or biochemical mechanisms. In *Drosophila*, sperm length is important for sperm competition, as long sperm outcompete short sperm in the female sperm storage organ, the seminal receptacle. Previous research in our lab identified a number of candidate genes that may influence sperm length in *D. melanogaster*. Here, we use quantitative polymerase chain reaction (qPCR) to characterize the RNA expression of three candidate genes in inbred lab populations with very long or very short sperm. cDNA was synthesized from RNA extracted from testes from both populations. Consequently, cDNA was utilized for qPCR with *ribosomal protein L32 (rpL32)* as the reference gene. Using Delta Ct analysis, we found that *tenectin (tnc)* and *crossveinless c (cvc)* are expressed in the short sperm populations compared to the long sperm populations. On the other hand, *Ecdysone-induced protein 74EF (Eip74ef)* was found to be expressed more in the long sperm populations, but due to irregular melting curve for that gene, new primers will be ordered and used to rerun qPCR for that gene. Future work will sequence portions of *tnc* to determine if DNA sequence level variation is also divergent between long- and short-sperm populations.

---

#### PRIMARY PRESENTER

---

Reem Al Shabeeb

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHORS

---

Reem Al Shabeeb

Mollie Manier

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Mollie Manier



---

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

## Comparative Genomics Meets Topology: A Novel View on Genome Median and Halving Problems

Genome median and genome halving are combinatorial optimization problems that aim at reconstruction of ancestral genomes by minimizing the number of evolutionary events between them and genomes of the extant species. While these problems have been widely studied in past decades, their solutions are often either not efficient or not biologically adequate. These shortcomings have been recently addressed by restricting the problems solution space.

We show that the restricted variants of genome median and halving problems are, in fact, closely related. We demonstrate that these problems have a neat topological interpretation in terms of embedded graphs and polygon gluings. We illustrate how such interpretation can lead to solutions to these problems in particular cases.

This study provides an unexpected link between comparative genomics and topology, and demonstrates advantages of solving genome median and halving problems within the topological framework.

---

**PRIMARY PRESENTER**

---

Pavel Avdeyev

---

**STATUS**

---

Student – Graduate

---

**AUTHORS**

---

Nikita Alexeev

Pavel Avdeyev

Max Alekseyev

---

**RESEARCH MENTOR/  
DEPARTMENT CHAIR**

---

Max Alekseyev



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Nociceptive Immunity: Allatostatin-C Regulates Host Survival Against Bacterial Infection

In the past, hypersensitivity to pain during bacterial infection was attributed solely to the innate immune response to a given microbe. However, recent studies have shown that certain bacteria are also able to activate pain-sensing neurons in mice through secreted toxins such as a  $\alpha$ -hemolysin as well as through membrane bound lipopolysaccharides. More interestingly, removal of pain-sensing neurons in mice has altered inflammation in diverse ways depending on the location of the ablated neurons. The question then arises as to whether bacteria are able to manipulate the host's local immune environment in their favor through nociceptor activation. This research aims to identify genes implicated in pain sensitization and to determine whether these genes have beneficial or detrimental effects on the host during infection. To test our hypothesis, we used loss and gain-of-function mutants of the fruit fly *Drosophila*, which is an outstanding model for studying host-pathogen interactions. The mutants were infected with non-pathogenic *Escherichia coli* bacteria or the insect-pathogenic bacteria *Photobacterium luminescens* and tested in heat escape essays, gene expression analysis, and survival experiments. Our findings reveal that the host immune response regulates nociceptive gene activation, which could potentially allow nociceptive neurons to participate in the defense against certain bacterial infections. Further research on the nociceptive-immune interphase could prove crucial in developing effective therapies for chronic pain syndrome, inflammatory conditions such as rheumatoid arthritis, as well as natural-antimicrobial agents.

---

#### PRIMARY PRESENTER

---

Nathaniel Bachtel

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHORS

---

Nathaniel Bachtel

Gary A. Hovsepian

Douglas F. Nixon

Ioannis Eleftherianos

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Ioannis Eleftherianos



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Development and Characterization of Low-Cost, Carbon Dioxide Sensors for Deployment throughout the Washington Metropolitan Area

The dramatic increase of carbon dioxide (CO<sub>2</sub>) concentrations in our atmosphere in recent decades is one of the most significant environmental concerns of our time. In order to inform the general public of the severity of CO<sub>2</sub> concentration rise, real-time data from a reliable source must be showcased. Although high-precision sensors are commercially available, these are not cost-effective for mapping a large spatial area. A goal of this research is to build out a network of low-cost sensors that are accurate and precise enough to provide a valuable data tool for accessing carbon emissions from a large, urban area.

Sensors developed in our lab (referred to as “Luftsinn” sensors) utilize a non-dispersive infrared (NDIR) sensor for measurement of CO<sub>2</sub> concentrations along with a combination temperature-pressure-humidity sensor. The sensors communicate using serial or I<sup>2</sup>C interfaces with a Raspberry Pi-3 microcontroller. Luftsinn units are powered by implementing Power Over Ethernet (PoE) or, alternatively, a 20 W solar panel that charges two 7 Ah batteries. Each Luftsinn unit broadcasts data to a website that leverages recent developments in open source GIS tools. In this way, data from individual sensors can be followed individually or aggregated to provide real-time, spatially-resolved data of CO<sub>2</sub> trends across a broad area.

Before these units are deployed in the DC area, they will undergo extensive calibration to ensure accuracy and precision of reported CO<sub>2</sub> concentrations. When implementing the K30 NDIR unit used here, three factors must be accounted for: sensor offset, temperature sensitivity, and pressure sensitivity. The latter two parameters will be corrected through the use of experimentally determined calibration curves programmed into the unit’s software. The sensor’s offset will be determined by flowing air scrubbed of CO<sub>2</sub>, using an Ascarite column, over the sensor and recording the value if not equal to zero. The final step before deployment is to compare each Luftsinn package to a cavity enhanced absorption sensor developed in our laboratory to account for non-linearity. This will ensure accuracy and precision are on the single-ppm level thus sufficient for scientific investigation.

---

#### PRIMARY PRESENTER

---

Esraa Ahmad

---

#### STATUS

---

Student – Graduate

---

#### CO-PRESENTER

---

Michelle Bailey

---

#### AUTHORS

---

Michelle Bailey

Esraa Ahmad

J. Houston Miller

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

J. Houston Miller



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### The Effects of Fungal Species Interactions on Wood Decomposition

Fungi are responsible for the majority of wood decomposition in temperate forests. The rate of wood decomposition is dependent on both the community of fungi that inhabit the wood and the substrate in which it is growing. Wood secondary chemistry can inhibit fungal growth and wood decomposition through high lignin content and antimicrobial properties. The species interactions within the substrate influence the respiration rates and total hyphal growth of a focal species. Specifically, the order in which fungal species colonize a substrate has been shown to have significant effects on fungal community successional patterns. We designed an experiment to investigate the difference in growth of four fungal species pairs commonly found fruiting together in mid Atlantic forests across two species of wood with high and low levels of secondary chemistry. We measured CO<sub>2</sub> respiration, hyphal growth rate, and total wood mass lost in microcosms inoculated in three treatments: each fungal species alone, fungal species pairs together, and each fungal species in its pair inoculated two weeks before the other. As expected, microcosms with species pairs—inoculated both simultaneously and one species before the other, showed greater respiration than that of each species alone. However, greater respiration rates were observed on *Quercus veluntina*, the wood substrate with greater secondary chemistry, opposing our hypothesis that less secondary chemistry would provide an easier substrate for the fungi to grow on. Further research on the specific enzymatic activity of the fungi as they interact is needed to understand the variations in fungal growth and their interaction with the substrate.

---

#### PRIMARY PRESENTER

---

Henry Betts

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHORS

---

Henry Betts

Amy Zanne

Amy Milo

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Amy Zanne



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Single-cell Temporal Proteomic Analysis in the Developing Frog (*Xenopus*) Embryo

Protein analysis at the single-cell level promises to deepen our understanding of cell-specific gene expression during early embryonic development. Unlike traditional mass spectrometry (MS) approaches, which average across a large number of cells, single cell analysis enables the deconvolution of important cell-to-cell differences. We previously developed a bottom-up proteomic approach using a custom single-cell capillary electrophoresis (CE) electrospray ionization (ESI) MS to decipher translational differences between dissected cells in the 16-cell frog (*Xenopus laevis*) embryo. To extend our study to progressively smaller cells in the developing embryo, we developed a capillary microsampling approach whereby a ~10 nL portion of the cell is collected using a pulled capillary. First, we evaluated three different solvent conditions for reconstituting the microsampled protein content and subsequent trypsin digestion from dorsal cells of the 16-cell embryo. All solutions were based on 50 mM ammonium bicarbonate, with the addition of 10% acetonitrile, or 0.1% RapiGest™. The three conditions were benchmarked against the same dissected cell as previously reported. After protein digestion, resulting peptides were separated and sequenced using our custom CE-ESI-MS instrument. The conditions constituted of 50 mM ammonium bicarbonate alone led to the highest number of identified proteins, with ~ 360 protein identified and 315 quantified. These results compared favorably to our previously reported protocol using embryo dissection. Comparison of the identified proteins' gene ontology between the different conditions did not reveal any differences.

---

#### PRIMARY PRESENTER

---

Camille Lombard-Banek

---

#### STATUS

---

Student – Graduate

---

#### AUTHORS

---

Camille Lombard-Banek

Aparna B. Baxi

Sally A. Moody

Peter Nemes

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Peter Nemes

Michael King



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### The Role of Proteasome in Human Amylin Turnover in Pancreatic $\beta$ -Cells

Human islet amylin polypeptide (IAPP), or amylin, is a 37-amino acid hormone co-secreted with insulin by pancreatic  $\beta$ -cells. Amylin functions in the body to regulate blood glucose levels and control appetite. However, amylin is also known to misfold and aggregate in pancreatic  $\beta$ -cells, which leads to insulin deficiency and Type II Diabetes Mellitus. In order to survive,  $\beta$ -cells must be able to degrade this harmful, misfolded form of amylin. It is well-established that cells use a proteolytic protein complex called the 26S proteasome to degrade proteins that are harmful or inoperative. The 26S proteasome has also been shown to regulate protein concentration via modulation of gene transcription. However, the role of 26S proteasome in intracellular turnover of human amylin is unclear. In this study, rat pancreatic insulinoma (RIN-m5F) cells were virally transfected to express the human amylin gene and treated with selective proteasome inhibitors, MG-132 and Epoxomicin. In order to test proteasome contribution to amylin turnover in  $\beta$ -cells, these inhibitors were applied at different concentrations (1-10  $\mu$ M) and time points (0-24h). Western blot analysis revealed a similar inhibitory effect of the two proteasome inhibitors on amylin production in cells: as the concentration of proteasome inhibitors increased, human amylin protein level decreased. The earliest effect of proteasome inhibition on amylin synthesis was observed at 4h, remaining low for the next 24h. This result indicates a profound and long lasting negative modulatory effect of proteasome activity on amylin biosynthesis in pancreatic  $\beta$ -cells. Future studies will reveal if this regulation of amylin turnover by the proteasome occurs at the transcriptional or translational level.

---

#### PRIMARY PRESENTER

---

Kathryn Cavanna

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHOR

---

Kathryn Cavanna

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Aleksandar Jeremic



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Characterizing the Role of *Ecdysone Induced Protein 74EF* in the Length of Sperm in Males and Seminal Receptacle in Females of *D. Melanogaster*

Sperm of *D. melanogaster* are among the longest known and are evolving in concert with the female's long, coiled sperm storage organ, the seminal receptacle (SR). During sperm competition, long sperm outcompete short sperm but primarily in long SRs, providing a post-copulatory analog to male trait-female preference coevolution, commonly modeled in pre-copulatory sexual selection. Sperm and SRs are also likely coevolving via Fisherian runaway sexual selection, as evidenced by a recently discovered genetic correlation between these two traits. We previously identified a number of candidate genes influencing sperm length using a RAD QTL sequencing approach and have prioritized *Ecdysone induced protein 74EF* (*Eip74EF*) due to its role in autophagy during development, post-meiotic expression during spermatogenesis (when spermatid elongation occurs), the presence of multiple SNP markers within the gene, and signatures of rapid evolution under positive selection among the 12 *Drosophila* genomes. We have found that knockout mutant males have shorter sperm, suggesting that *Eip74EF* acts on the positive regulation of sperm length. We are also investigating female mutants to determine if a similar pattern exists for SR length. If so, *Eip74EF* may have pleiotropic effects on both sperm length and SR length and may therefore be a key to the molecular mechanism of Fisherian runaway sexual selection. Both male and female mutants also have decreased fertility relative to control flies, and males have reduced sperm competitive success, consistent with the expectation that shorter sperm are weaker competitors.

---

#### PRIMARY PRESENTER

---

Sharif Chebbo

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHORS

---

Sharif Chebbo

Mollie Manier

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Mollie Manier



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Strange from the Start: Ontogeny of the Filtering Mechanism in Silver Carp

Highly invasive Asian carp are destroying ecosystems throughout the United States by outcompeting native species. With populations growing at an alarming rate, these fish have proven difficult to control. Their ability to thrive within eutrophic environments is due to their very efficient filter-feeding mechanism. Here we present data from an ontogenetic series of Silver Carp ranging in size from 15-900mm SL detailing how this unique filtering structure is built. Like many filter-feeding species, Silver carp possess an incredibly large epibranchial organ that occupies the majority of the dorsal buccal cavity. Branchial arches 1-5 have greatly modified gill rakers that span both the ceratobranchial ventrally and the epibranchial as it curves into the body of the epibranchial organ. From the earliest ontogenetic stage examined individual gill rakers already show a modified shape as compared to the basal character state for Cypriniformes. As development proceeds the structure of these gill rakers becomes increasingly complex. By early juvenile stages secondary growth of bone stitches together the primary lamellae, forming a screen-like mesh upon which future elaborations of the filtering structures are built. As development proceeds the individual lamellae of gill rakers maintain their shape as they increase in height. These lamellae will later become scaffolding for more complex filtering structures. Gill rakers involved in filtering undergo significant architectural changes during development. However, those curling into the epibranchial organ undergo separate structural changes due to the morphological constraints of the epibranchial organ. Comparisons with the Bighead carp, a congeneric, suggest the Bighead morphology more closely resembles that of the basal cypriniform condition.

---

#### PRIMARY PRESENTER

---

Karly Cohen

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHORS

---

Karly Cohen

L. Patricia Hernandez

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

L. Patricia Hernandez



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### The Role of the Prophenoloxidase Activating System in the *Drosophila* Anti-Nematode Innate Immune Response

The melanization pathway is an important part of the innate immune system in the model organism *Drosophila melanogaster*. The reaction has been demonstrated as a powerful tool against invading microbes and in wound healing. Melanin synthesis is controlled by the enzyme phenoloxidase. Prophenoloxidase (PPO), the inactive precursor of phenoloxidase, is encoded by three genes; *PPO1*, *PPO2* and *PPO3*. Despite the importance of this system in antimicrobial immunity, little is known about the specific roles of each PPO gene in the immune response to nematode infection. The parasitic nematode *Steinernema carpocapse*, together with its mutualistic bacteria *Xenorhabdus nematophila*, is capable of infecting and killing insects. The nematodes devoid of their associated bacteria are viable while remaining infectious, and *Drosophila PPO* genes can be mutated individually or in combinations. This provides an elegant model for investigating the immune response of *Drosophila* against the nematode-bacteria complex, and against the nematode alone. Survival data suggest that while all PPO proteins contribute to *Drosophila* survival, *PPO3* may play a more significant role, as mortality among these mutants is significantly increased. Interestingly, *PPO2,3* double-mutants survive better than *PPO3* mutant counterparts, suggesting a possible interplay between PPO proteins. Gene expression research is currently in progress and may shed light on how the *Drosophila PPO* genes are regulated during nematode infection.

---

#### PRIMARY PRESENTER

---

Dustin Cooper

---

#### STATUS

---

Student – Graduate

---

#### AUTHOR

---

Dustin Cooper

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Ioannis Eleftherianos

---

# NATURAL SCIENCES AND MATHEMATICS

---



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Development and Improvement of a Laser Heterodyne Radiometer to Simultaneously Measure Atmospheric Carbon Dioxide and Methane

Human actions, such as deforestation and fossil fuel burning, have led to a significant increase in atmospheric carbon dioxide (CO<sub>2</sub>) concentrations. In recognition of that reality, the 2010 Congressional Appropriation to NASA called for the development of a Carbon Monitoring System (CMS), and NASA's strategy to meet this challenge depends strongly on satellite remote sensing products. The primary validation tool for the Orbiting Carbon Observatory 2 (OCO-2) is from a series of ground-based, solar-looking, Fourier Transform Spectrometers (the Total Carbon Column Observing Network–TCCON) that obtain observations during daylight hours. Unfortunately, these installations are expensive and currently there are only 27 TCCON sites worldwide, 5 of which are in the US. Satellite measurements are easily affected by fluxes in cloud coverage and aerosol interferences, have modest spatial resolution, and struggle with high latitude measurements. Laser heterodyne radiometry (LHR) is a relatively low-cost, atmospheric column measurement that can be ruggedized for deployment to remote locations. LHR boasts high spectral resolution in addition to being able to autonomously and continuously collect information on column CO<sub>2</sub> concentrations during the daytime. LHR works by combining sunlight that has been absorbed by a trace gas, such as CO<sub>2</sub>, with light from a distributed feedback (DFB) diode laser. By mixing the laser light and sunlight that has undergone absorption on an optical fiber, we will be able to observe the absorption as a dip in the difference (RF) signal power as the laser is tuned through an absorption feature. The goals of this project are to improve existing LHR designs by increasing sampling speeds, reducing the amount of power consumed by electronic components, and simplifying solar tracking by incorporating a low-cost, commercial telescope mount into our design.

---

#### PRIMARY PRESENTER

---

Adrienne Coulter

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHORS

---

Adrienne Coulter

D. Michelle Bailey

J. Houston Miller

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

J. Houston Miller



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### The Role of Calnexin in Cholesterol Transport Impairment in HIV Infection and Tangier Disease

HIV-1 infection is associated with an increased risk of developing atherosclerosis. Studies have shown that impairment of cholesterol transporter ATP-Binding Cassette A1 (ABCA1) is an important contributor to this co-morbidity. ABCA1 mediates the efflux of cholesterol, and nonfunctioning ABCA1 results in a buildup of cholesterol within the cell and leads to the development of foam cells (fat laden macrophages). Foam cells form plaques within arteries and can result in development of atherosclerosis. Maturation of ABCA1 depends on its interaction with the endoplasmic reticulum (ER) chaperone calnexin, a protein responsible for the folding of ABCA1. HIV protein Nef binds to calnexin and prevents its interaction with ABCA1 and transport of ABCA1 to the plasma membrane. Previously, our lab used confocal microscopic techniques to show ABCA1 retention in the ER in HIV-infected macrophages. This phenotype was reminiscent of ABCA1 distribution in cells transfected with ABCA1 mutants, Q597R and R587W, characteristic of a genetic disorder called Tangier Disease. We hypothesized that these mutations were responsible for weakened interaction between calnexin and ABCA1, similar to the mechanism engaged by Nef in HIV-infected cells. However, our results demonstrated that ABCA1 mutants bind more strongly to calnexin than the wild type ABCA1. We therefore concluded that an optimal level of ABCA1-calnexin binding is necessary for normal cholesterol efflux; both increased and decreased affinity of calnexin binding retains ABCA1 in the ER and affects cholesterol efflux. Current study focuses on testing whether Nef, by decreasing interaction between Q597R and R587W ABCA1 mutants with calnexin, can reverse retention of mutant ABCA1 in the ER and rescue cholesterol efflux. A positive result could possibly suggest a therapeutic approach for treating Tangier disease by Nef-mimicking peptides. Our results from confocal microscopy imaging of cells co-transfected with Q597R and Nef show that distribution of ABCA1 is more similar to that of wild type cells, providing initial qualitative evidence that our hypothesis may be true. By conducting cholesterol efflux assays in live cells, we have also demonstrated that introduction of Nef into cells transfected with Q597R ABCA1 substantially improved cholesterol efflux, suggesting that the Nef-calnexin interaction led to release of ABCA1 from the ER. Current investigation focuses on determining whether Q597R ABCA1 relocalization to the plasma membrane and restored cholesterol efflux are caused by Nef-mediated disruption of the abnormally strong interaction between Q597R ABCA1 and calnexin.

---

#### PRIMARY PRESENTER

---

Christina Darwish

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHOR

---

Christina Darwish

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Michael Bukrinsky



## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

### Derivatization and Modification of Silicon Nanopost Arrays for Enhanced Molecular Coverage and Ionization Efficiency in Laser Desorption Ionization Mass Spectrometry

Silicon nanopost arrays (NAPA) provide an analytical platform with ultra-trace sensitivity based on matrix-free laser desorption ionization (LD) mass spectrometry (MS). For enhanced capabilities, e.g., the selective capture of specific analytes or broader molecular coverage, NAPA may be modified by silane chemistry to derivatize the nanopost surfaces. In this contribution, we report on several functionalized NAPA substrates designed to increase molecular coverage and ionization efficiency by manipulating the NAPA surface affinity for particular classes of compounds based on their polarity. Derivatizations included both highly polar and highly nonpolar surfaces, and the modifications focused on providing a source of protons to further enhance ionization efficiency. Functionalized platforms were examined by comparing the laser fluence dependence of quasimolecular and fragment ion intensities for compounds of various polarities. The NAPA substrate was initially oxidized by ozone exposure to form silanol groups at the surface of the nanoposts. Subsequently, surfaces that were derivatized to be hydrophobic were treated with 3-(pentafluorophenyl)-propyldimethylchlorosilane (PFP) and baked for 30 min at 90 °C. Conversely, surfaces derivatized to be hydrophilic underwent oxidation and then photograft polymerization to attach polar zwitterionic groups. The proton source enriched surface modification was produced by treating the oxidized NAPA surface with 1 mM NaOH, resulting in higher OH group coverage on the nanopost surfaces. Approximate contact angle measurements yielded  $41.0^\circ \pm 0.9$ ,  $133.2^\circ \pm 2.0$ , and  $6.0^\circ \pm 0.5$  for underivatized, PFP, and zwitterionic surfaces, respectively, thus illustrating successful derivatization resulting in superhydrophobic and hydrophilic surfaces. A broader molecular coverage resulted from complementary analysis from the different functionalized substrates. For example, standard analysis of histidine, a polar amino acid, indicated a > 4-fold intensity gain from the highly polar zwitterionic derivatized surface when compared to underivatized NAPA. Moreover, the OH enriched surface exhibited increased sensitivity for high proton affinity amino acids, e.g., a > 3-fold intensity gain in arginine compared to unmodified NAPA. These results are interpreted as a consequence of acid-base chemistry occurring at the surface of the nanoposts. Ultimately, the examples discussed in this study indicate that derivatization, used to modulate the interfacial energy between the sample solution and the NAPA substrate, and surface modification, used to introduce additional sources of protons, may serve to enhance ion production from complex samples in matrix-free LDI.

#### PRIMARY PRESENTER

Jacqueline E. Dyer

#### STATUS

Student – Undergraduate

#### AUTHORS

Jacqueline E. Dyer

Jarod A. Fincher

Rachelle S. Jacobson

Nicholas J. Morris

Matthew J. Powell

Akos Vertes

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

Akos Vertes



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### From an Impurity to a Promising Dimer: Isolation, Identification, and Synthesis of a New Ligand Leading to the Formation of Thermo-chromic Complexes

A side product formed during the synthesis reaction of ethyl-4-pyrazolecarboxylate is isolated, purified, and identified by IR, NMR, and MS. The analyses show a hydrazine molecule linked two ethyl 2,2-diformylacetate molecules, making a dimer. The synthesis of the new dimer uses a 1:2 ratio of hydrazine hydrate to ethyl 2,2-diformylacetate, resulting in a 70% yield. The dimer shows two coordination sites, each reminiscent of acetylacetonate, linked by a nitrogen-nitrogen bond. Prompted by potential applications, such as catalysis, metal-organic frameworks, and magnetic complexes, we are investigating the dimer as an organic ligand by coordination with various metal cations. Recent results suggest the ligand is noninnocent, which leads to interesting thermo-chromic behavior.

---

#### PRIMARY PRESENTER

---

Colten Eberhard

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHORS

---

Colten Eberhard

Claire Besson

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Claire Besson



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Chemical Composition of Carbon Inksticks Revealed through Raman Spectroscopy

Carbon-based black pigments have been used extensively in art objects, and remain the most common black pigments in the art world. However, it has proven difficult to gain more information about the pigment's origin beyond the fact that it is a carbon-based, black pigment. Graphite and charcoal can sometimes be identified microscopically through their physical morphology at the micrometer size. Recent studies have shown that Raman spectroscopy is also able to discriminate between graphite, charcoals, and carbon-based earth pigments. However, soot-based black pigments, those in the most popular use, remain a challenge to discriminate. Raman spectroscopy has been shown to yield valuable information about soot's chemical morphology but has yet to be applied to artists' pigments. In this paper, we combine surface enhanced Raman spectroscopy (SERS) with traditional Raman spectroscopy to analyze East Asian inkstick samples in an effort to establish their provenance. Traditional Raman spectroscopy is used to analyze the soot pigment itself while identification of binders and other additives to the paints is provided by SERS. This dual technique has allowed us to discriminate between different combustion-based artists' materials.

---

#### PRIMARY PRESENTER

---

Jennifer Giaccai

---

#### STATUS

---

Student – Graduate

---

#### AUTHORS

---

Jennifer Giaccai

J. Houston Miller

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

J. Houston Miller



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Annotation of the Gene *Sox102F* on the Dot Chromosome of *Drosophila EUGRACILIS* Demonstrates Moderate Conservation

Identification and subsequent annotation of all genes that are found on the dot chromosome across species of different *Drosophila* can increase our understanding of how chromatin structure is linked to gene expression. The Genomics Education Partnership (GEP) is especially interested in verifying gene models for the *D. eugracilis* dot chromosome by annotation and comparison with known *D. melanogaster* references because of its well-mapped genome. The dot chromosome is of particular interest, because it has heterochromatic regions yet still remains transcriptionally active.

*Sox102F* gene in *D. melanogaster* has been previously linked as a transcription factor that is crucial in the development of the heart and cardiac function. Moreover, it serves in the cardiovascular system in wing vein development and pattern. The gene *Sox102F* on contig 28 of *D. eugracilis* was annotated using Flybase BLAST, Gene Record Finder, Gene Model Checker and UCSC Genome Browser. There were four total *Sox102F*- isoforms present (-PA, -PB, -PC & -PD). Isoforms *Sox102F-PA*, *Sox102F-PC*, and *Sox102F-PD* were all identical.

These methods revealed moderate gene conservation at 83.2% between *D. eugracilis* and *D. melanogaster* without insertion or deletion events and a gap of only 3.6%. This moderate gene conservation makes it was also found that isoform *Sox102-PB* is not found in *D. melanogaster*, and must have been lost somewhere along the way evolutionarily. Further experimentation could increase the knowledge surrounding the difference in isoforms, and possible difference in functionality of the protein for which the *Sox102F* exon encodes.

---

#### PRIMARY PRESENTER

---

Alexandra Gross

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHORS

---

Alexandra Gross

Mollie K. Manier

Katherine Buckley

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Mollie K. Manier



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Omo-Kibish Skeleton and Implications for Stature and Proportions in the Earliest Modern Humans

The Omo-Kibish skeleton (Omo I) is the earliest known anatomically modern human (~195ka). The fossil was recovered from the Kibish Site, in southern Ethiopia, during field seasons in the 1960s and again in the early 2000s. Much of what we thought we knew about Omo I stems from the cranium, which was assumed to be a male primarily because of its large size, but a more recently-recovered os coxa from Omo I has been preliminarily described as displaying female-like morphologies. If early modern human females were as large as Omo I, this could have important implications for the paleobiology of early modern humans.

Here we re-evaluate the sex of the Omo I hipbone based on indicators such as sciatic notch shape, preauricular sulcus form, and piriform tubercle morphology. We also predict stature in the Omo I individual based on a number of preserved skeletal elements (i.e., humerus length, clavicle length, hip joint size, distal femur breadth, metatarsal length, talus length) using published regression formulae.

The pelvic morphology of Omo I is consistent with a female sex attribution. The pelvis is very robust and the acetabulum size is large, even exceeding the size of many Neanderthals, resulting in stature estimates that are relatively tall for a female (~5'6"-6'0"). One particularly interesting finding is that upper limb elements and the hip joint predict a tall stature, but lower limb elements predict a substantially shorter stature. This may suggest that the earliest modern human females might have also retained slightly different limb proportions than are normally observed in recent humans. Limb proportions and the breadth and size of the pelvis are associated with thermoregulatory adaptations, making Omo I key for understanding the pelvic morphology of the earliest modern humans prior to human global expansion, regional adaptation, and admixture.

---

#### PRIMARY PRESENTER

---

Ashley Hammond

---

#### STATUS

---

Postdoctoral Student

---

#### CO-PRESENTER

---

John Fleagle

---

#### AUTHORS

---

Ashley Hammond

John Fleagle

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Chet Sherwood

---

# NATURAL SCIENCES AND MATHEMATICS

---



---

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

## A Multi-Wavelength Machine Learning Approach to Classify Unidentified X-Ray Sources

Modern observatories (e.g., Fermi, HESS, Integral) have greatly increased the number of discovered gamma-ray sources and this number continues to grow. In order to understand the galactic population and nature of these sources it is important to classify them. One of the most efficient ways to accomplish this is to look for counterparts at lower energies, particularly, at X-ray and radio wavelengths. However, this task is challenging because each gamma-ray source is likely to have multiple unidentified X-ray sources within its extent and each of those sources may also have counterparts in the optical and near-IR. Therefore to have a reliable classification many multi-wavelength parameters need to be taken into account. We adopt an automated machine-learning approach, which relies on up to 19 multi-wavelength parameters extracted for each source from public catalogs. We have also built a comprehensive training dataset comprised of thousands of known objects of various astrophysical types. Accurate X-ray source classification will provide plausible counterparts for gamma-ray sources shedding light on their nature.

---

**PRIMARY PRESENTER**

---

Jeremy Hare

---

**STATUS**

---

Student – Graduate

---

**AUTHORS**

---

Jeremy Hare

Oleg Kargaltsev

Blagoy Rangelov

George Pavlov

Igor Volkov

---

**RESEARCH MENTOR/  
DEPARTMENT CHAIR**

---

Oleg Kargaltsev



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Lipid Droplets Act as Modulators of the *Drosophila* Immune Response

Lipid droplets (LDs) are independent organelles mainly responsible for storage of neutral lipid and are involved in lipid metabolism and energy homeostasis. Recent evidence suggests that LDs have increased activity and participate in additional processes, including immunity. Here we show that interfering with certain immune signaling pathways of the fruit fly *Drosophila* through infection or genetic manipulation results in the enlargement of fat body LDs. In addition, several lipid metabolism genes were misregulated in flies with activated immune system. In particular, we found that the lipolytic genes were downregulated while the lipid biogenesis machinery was upregulated in the fat body cells of these flies. Starvation experiments further revealed that these flies display impaired lipid mobilization and thus are more sensitive to starvation. This is the first in vivo demonstration linking lipid droplets and immunity in *Drosophila*. Further investigations will establish the exact role of lipid droplets in imparting immunity to *Drosophila*. These findings indicate that LDs act as regulators of the immune response and will potentially open new avenues of investigation in the field of host-pathogen interactions.

---

#### PRIMARY PRESENTER

---

Sneh Harsh

---

#### STATUS

---

Postdoctoral Student

---

#### AUTHORS

---

Sneh Harsh

Ioannis Eleftherianos

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Ioannis Eleftherianos



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Glycerol Transfer Hydrogenation of CO<sub>2</sub> using NHC Ir and Ru Organometallics Immobilized on Hydrotalcites

The hydrogenation of CO<sub>2</sub> is a fundamental method for converting this greenhouse gas to value-added commodity chemicals, such as formic acid. Transfer hydrogenation, especially from glycerol, a low value byproduct of biodiesel synthesis, is a highly desirable process due to the formation of two value-added products—from CO<sub>2</sub> and from glycerol. This reaction is however, thermodynamically and kinetically challenging, which is why it has not yet been developed into a practical process. Here we report the development of single-site supported heterogeneous catalysts consisting of Ir and Ru N-heterocyclic carbenes catalysts immobilized on hydrotalcite (HT) supports, for CO<sub>2</sub> transfer hydrogenation from glycerol. The catalysts are extensively characterized to determine structure-property-activity relationships between supports and immobilized catalysts. The reaction produces potassium formate and potassium lactate in a high pressure batch reactor using 650 psi CO<sub>2</sub> pressure. Comparison of the heterogeneous catalysts to their respective homogenous catalysts indicate that the HT is non-innocent during the reaction. The catalyst testing is extended to a flow reactor, which allowed collection of detailed kinetic data and testing of catalyst stability under industrially relevant conditions. The optimized catalysts are stable for over 200 hours on stream at 150-225°C and shows high turnover frequencies.

---

#### PRIMARY PRESENTER

---

Jacob Heltzel

---

#### STATUS

---

Postdoctoral Student

---

#### AUTHORS

---

Jacob Heltzel

Matthew Finn

Nan An

Adelina Voutchkova-Kostal

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Adelina Voutchkova-Kostal



---

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

## Contradiction – Detecting Contradictions in Text

Language structures may come in a variety of forms, but are always received sequentially as meaning unfolds to the interpreter. Large bodies of text can create a myriad of relationships and concepts, often making it difficult to detect contradictions between elements that are far apart. This work explores the combination of deterministic and non-deterministic solutions for detecting relationships within syntactic structures, mapping those relationships, and determining if a negation in those relationships is 'decidable'. The goal is to optimize object-relationship mapping. Different parsing methods are expected to affect mapping and evaluation outcomes. The approach aims to assess deterministic parsing, such as based on lexical grammar structures, along with multinomial logistic regression in language modeling and stochastic semantic analysis for deriving relationship values; and to furthermore experiment using logical deductions to create predicate logic, through which the system may re-deduce to determine a logical coherence level. High coherence levels may be used to isolate confident relationships between objects and attributes to be compared with qualities inferred on those objects throughout the input text.

---

**PRIMARY PRESENTER**

---

Rami Houssami

---

**STATUS**

---

Student – Graduate

---

**AUTHOR**

---

Rami Houssami

---

**RESEARCH MENTOR/  
DEPARTMENT CHAIR**

---

Raffi Teperdjian



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Chiral Extrapolation of Light Mesons from the Lattice

The  $\rho(770)$  meson is the most extensively studied resonance in lattice QCD simulations in two ( $N_f=2$ ) and three ( $N_f=2+1$ ) flavors. We analyze all available phase shifts from  $N_f=2$  simulations using unitarized Chiral Perturbation Theory (UCHPT), and allowing not only for the extrapolation in mass but also in flavor,  $N_f=2 \rightarrow N_f=2+1$ . The flavor extrapolation requires information from a global fit to  $\pi\pi$  and  $\pi K$  phase shifts from experiment. In the chiral extrapolations of  $N_f=2$  simulations, the  $KK\bar{K}$  channel has a significant effect and leads to  $\rho(770)$  masses surprisingly close to the experimental one. We also discuss recent results on the chiral extrapolations of  $N_f=2+1$  lattice QCD data.

---

#### PRIMARY PRESENTER

---

Bin Hu

---

#### STATUS

---

Student – Graduate

---

#### AUTHORS

---

Bin Hu

Michael Doring

Maxim Mai

Raquel Molina

Andrei Alexandru

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Michael Doring



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Bonobos Exhibit Higher Connectivity in the Ventral Anterior Cingulate Cortex Relative to Chimpanzees

Despite being closely related, bonobos and chimpanzees exhibit some remarkable behavioral differences. It has been reported that chimpanzees tend to be more aggressive, territorial, and risk-taking, while bonobos exhibit greater social tolerance, higher rates of socio-sexual interactions, and risk-averseness. To elucidate the potential neuroanatomical changes that might accompany these differences, we examined the cytoarchitecture of selected brain areas implicated in these behaviors. In bonobos and chimpanzees, we compared neuropil fraction of the anterior cingulate cortex (ACC), a region associated with cognitive and emotional processing, and the nucleus accumbens (NAc), which is associated with risk/reward decision-making and control. The putamen was included as a control region. The neuropil fraction quantifies unstained space surrounding cell bodies in histological sections and therefore serves as a proxy for the amount of connectivity in a given region. Bonobos had overall higher neuropil fractions in the ACC compared to chimpanzees, but the effect was only significant in layers V-VI of the ventral part of the ACC ( $F(1,8)=5.63$ ,  $p=0.005$ ). No significant inter-species differences were found in the NAc ( $t(10)=0.38$ ,  $p=0.709$ ) or the putamen ( $t(10)=-0.34$ ,  $p=0.709$ ). As the ACC is anatomically divided into a dorsal “cognitive” and ventral “affective” area, the higher connectivity in the ventral ACC in bonobos may be associated with species differences in socio-emotional behaviors or temperaments. Further research will examine if variation in the number of Von Economo neurons of the ACC may provide additional insight into the neural basis of behavioral differences between bonobos and chimpanzees.

---

#### PRIMARY PRESENTER

---

Habon Issa

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHORS

---

Habon Issa

Nicky Staes

Jared Tagliatalata

Cheryl Stimpson

William Hopkins

Chet Sherwood

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Chet Sherwood



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Extinction Measurements Near 3.0 Micrometers in Nitrogen-Diluted, Ethylene, Non-Premixed Flames

Several recent studies have reported substantial aliphatic composition in collected nascent particulate from rich flames. These results would have a profound impact on a conventional view of soot nucleation that begins with the agglomeration of polynuclear aromatic hydrocarbons. To rule out sampling artifacts that might accompany sample extraction, the current study was initiated to explore an *in situ* optical measurement of extinction in the carbon-hydrogen stretching fingerprint region using an external-cavity, quantum cascade laser operating between 2980 and 3170  $\text{cm}^{-1}$ . The target system for this work is a nitrogen-diluted, ethylene air flame supported on a "Yale", co-annular burner. This work uses a similar optical train as has been reported for recent work from our laboratory in which visible light from a supercontinuum light source was employed to determine the optical band gap of soot in this and other non-premixed flame systems. The spectral region of the mid infrared laser spans frequencies diagnostic for carbon-hydrogen stretching vibrations typical of single, double, and triple bonded carbon as well as those typical of aromatic C-H bonds.

While the incomplete combustion of fuel continues to put soot into the atmosphere, there are still many unanswered questions about the structure and formation of soot. There are currently many theories about the formation of soot particles, but there is still some uncertainty surrounding the mechanism of particle inception and the transition from condensation to coalescence. Particularly whether aliphatic hydrocarbons play a role in the soot formation process remains a source of debate. Here we are using a mid-infrared tunable quantum cascade laser to investigate the type of C-H bonds distributed throughout a standardized sooting flame. By using light in the 2980-3170  $\text{cm}^{-1}$  range, we will be able to evaluate the contribution of aromatic and aliphatic groups to the soot formation process. This will be done by line-of-sight *in situ* extinction measurements throughout a laminar co-flow nitrogen-diluted ethylene-air diffusion flame supported on the Yale burner.

---

#### PRIMARY PRESENTER

---

Rachelle Jacobson

---

#### STATUS

---

Student – Graduate

---

#### AUTHORS

---

Rachelle S. Jacobson

D. Michelle Bailey

Erin Adkins

J. Houston Miller

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

J. Houston Miller



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Neutron Vortex Diffraction and Scattering through Crystal Mediums

Neutron scattering is particularly useful in determining the molecular composition and purity of a given substance because incident neutrons' lack of charge allows them to cut through the electron cloud and interact directly with the nucleus, causing different isotopes with different scattering cross-sections to effect different scattering solutions. In the context of this project whereby a crystalline sample is subjected to a neutron vortex, I will use classical hard sphere scattering principles while adjusting my models in Mathematica to account for nuclear spin. The beam will be twisted in a vortex with defined angular momentum so that the neutrons' small magnetic moment can be employed to create elastic interactions with the crystal according to the principles of Bragg-Laue diffraction and Small Angle Neutron Scattering (SANS). The plan will be to utilize the High Resolution Powder Diffractometer - BT1 at NIST's Center for Neutron Research (NCNR) to measure diffraction patterns and map crystalline structure with the twisted beam.

---

#### PRIMARY PRESENTER

---

Matthew Kasturas

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHOR

---

Matthew Kasturas

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Andrei Afanasev

---

# NATURAL SCIENCES AND MATHEMATICS

---



---

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

## Algorithms for Mathematical Redistricting

This study proposes original algorithms that divide Maryland into optimal congressional districts with no gerrymandering or any other partisan input. Looking at the map of Maryland's congressional districts, we find eight highly gerrymandered districts. Gerrymandering is an unfair political practice, since the district-drawers create unnatural electoral boundaries to favor certain political parties. In order to create politically impartial drawings, redistricting algorithms are designed to optimize district compactness with only official census data. Each person is treated the same, regardless of his or her gender, race, political interest, or other factors. The algorithms are designed to strike a balance between keeping the population equal and making the congressional districts compact. The same algorithms can also be applied to other US states.

---

**PRIMARY PRESENTER**

---

Yujing Ke

---

**STATUS**

---

Student – Undergraduate

---

**AUTHORS**

---

Yujing Ke

Daniel Ullman

---

**RESEARCH MENTOR/  
DEPARTMENT CHAIR**

---

Daniel Ullman



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### *Heterorhabditis Bacteriophora* Candidate Virulence Factor Regulation Upon Exposure to an Insect Host

Clade V of the phylum Nematoda contains a number parasites, with a mixture of species that infect vertebrates or invertebrates, and accordingly these parasites have a range of impacts on agriculture and human health, including the use of entomopathogenic nematodes for the biocontrol of insect pests and the 700 million enteric infections attributed to hookworm each year. Despite substantial differences in host range, the common evolutionary history of these parasites indicates that they may share foundational molecular mechanisms that enabled their ancestral transition to parasitism. Based on the results of an RNA-seq assay that identified host-induced, parasite-specific genes in *Heterorhabditis bacteriophora*, 17 such candidate factors have been selected for further investigation in the context of an infection of *Drosophila melanogaster*. For the original RNA-seq assay, *H. bacteriophora* were induced in *Manduca sexta* hemolymph, as this species is a natural host of the nematode, but in the interest of developing a model that could be used to study the mechanics of an infection, a transition to *Drosophila* represents the availability of a far broader range of genetic and physiological tools. To this end, the expression of the candidate genes has been re-examined based on exposure to *Drosophila* hemolymph, and two specific genes, the invertebrate lysozyme Hba\_19909 and the serine-type carboxypeptidase Hba\_11636 have been selected for recombinant expression and an investigation of their interactions with the *Drosophila* immune system. The elevated expression of these genes in response to host hemolymph along with the presence of orthologous genes in hookworm and absence of orthologs in the non-parasitic *Caenorhabditis elegans* indicates that these genes may play an influential role in infection and could serve as targets for the effective manipulation of the infection process, either in the form of anthelmintic drugs or the enhancement of parasites that control insect pests.

---

#### PRIMARY PRESENTER

---

Eric Kenney

---

#### STATUS

---

Student – Graduate

---

#### AUTHORS

---

Eric Kenney

Ioannis Eleftherianos

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Ioannis Eleftherianos



## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

### Automated Multimodal Imaging System to Explore the Mechanism of Biological Nitrogen Fixation Based on Fluorescence Microscopy and Laser Ablation Electrospray Ionization Mass Spectrometry

Some prokaryotic bacterial species partake in biological nitrogen fixation (BNF) through symbiosis with host plants. In BNF atmospheric nitrogen is reduced to a biologically useful species, ammonia, which is then utilized by the host plants in the synthesis of essential biomolecules, e.g., proteins and nucleic acids. For example, a symbiotic relationship between legumes and soil rhizobia leads to the formation of root nodules, the active site of BNF. In this contribution, mass spectrometry (MS) techniques, based on laser ablation electrospray ionization (LAESI), are used to investigate biomolecules participating in BNF. They provide the basis for metabolic engineering with potential impact on a larger agricultural scale. We describe a multimodal technique capable of MS molecular profiling in combination with optical imaging to differentiate cell types and morphologies by fluorescence and brightfield imaging, respectively.

Soybean (*Glycine max*) root nodules were sectioned to a thickness of  $\sim 200 \mu\text{m}$ . A Peltier cooling stage was used to maintain the sample temperature at  $\sim 0^\circ\text{C}$ . A Nd:YAG laser was used to pump an optical parametric oscillator tuned to 2940 nm. The nanosecond laser pulses are coupled directly into the soybean section. Within the optical train, a dual-channel microscope capable of GFP fluorescence and brightfield imaging is integrated to provide imaging for the selective targeting of bacteroid cells or cell clusters infected by GFP-tagged bacteria. Using an automated XY-stage driven by LabVIEW software, we can create a raster pattern for LAESI-MS imaging. At each pixel of this image, the mid-IR laser pulse produces an ablation plume that is ionized by electrospray and sampled by the mass spectrometer.

Currently, this newly developed system is being tested for BNF studies. The implementation of high performance optics for ablation reduced spherical aberration, resulting in a  $50 \mu\text{m}$  spot size. The ability of the microscope for fluorescent and brightfield imaging allowed for selective targeting of cells infected by the bacteria. Using the automated stage movement, cells of root and nodule sections were analyzed. Nitrogen containing metabolites, such as choline and arginine, were abundant in the soybean nodule, whereas hexose and disaccharides were found in both the root and nodule segments.

Using this newly developed multi-modal imaging system with automated stage movement, further studies are underway to gain deeper insight into biological processes, such as BNF, at cellular resolution.

#### PRIMARY PRESENTER

Rikkita Khattar

#### STATUS

Student – Undergraduate

#### AUTHORS

Rikkita Khattar

Sylwia Stopka

Beverly Agtuca

Christopher Anderton

David Koppenaar

Ljiljana Pasa-Tolic

Gary Stacey

Akos Vertes

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

Akos Vertes



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Probing Different Emission Components in Gamma-Ray Burst Light Curves

Gamma Ray Bursts (GRBs) allow us to probe different regions of the universe by analysis of their environments, progenitors (be it a massive star or binary compact object merger), and remnants. Besides gamma rays, these sources emit radiation across the electromagnetic spectrum, the so-called afterglow. Observing this emission allows us to observe these fast outflows and study physics under the most extreme circumstances. To effectively analyze their characteristics and provide contextual insight to the importance of GRBs, one method to incite simultaneous quantitative and qualitative investigation is through the computational construction and study of multi-wavelength spectra and light curves. This project focuses on light curves that evolve in regards to various physical effects during a GRB event. I have created a numerical C-code calculating light curves using formulae for synchrotron and blackbody radiation. This is visualized in Mathematica, where the numeric scales and graphical representations can be adjusted, and the simulated light curves can be analyzed and compared to observational data. In this way it is possible to study the different emission components in gamma-ray burst light curves.

---

#### PRIMARY PRESENTER

---

Alexandra Alessi Kidd

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHOR

---

Alexandra Alessi Kidd

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Alexander J. van der Horst

---

# NATURAL SCIENCES AND MATHEMATICS

---



---

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

## High-energy Emission from the Region of Pulsar B0355+54

The field containing Pulsar B0355+54 hosts a nearby unidentified gamma-ray source, 3FGL J0359.5+5413. Deep observations with the Chandra X-ray Observatory reveal that the 3FGL source is coincident with 3 X-ray sources. We present multiwavelength (radio, visible, X-ray, and gamma-ray) observations and analyses of the pulsar and its wind nebula, the gamma-ray source, and the 3 unidentified X-ray sources with the goal of identifying the lower-energy X-ray counterpart to the gamma-ray source and establish its nature. This research makes use of NASA space observatories and is supported by NASA grants.

---

**PRIMARY PRESENTER**

---

Noel Klingler

---

**STATUS**

---

Student – Graduate

---

**AUTHORS**

---

Noel Klingler

Oleg Kargaltsev

---

**RESEARCH MENTOR/  
DEPARTMENT CHAIR**

---

Oleg Kargaltsev



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Immune Roles of Amphibian (*Xenopus Laevis*) Tadpole Granulocytes During Frog Virus 3 Ranavirus Infections

Infections by Frog Virus 3 (FV3) and other ranaviruses (RVs) are contributing to the amphibian declines, while the mechanisms controlling anuran tadpole susceptibility and adult frog resistance to RVs, including the roles of polymorphonuclear granulocytes (PMNs) during anti-FV3 responses, remain largely unknown. Since amphibian kidneys represent an important FV3 target, the inability of amphibian (*Xenopus laevis*) tadpoles to mount effective kidney inflammatory responses to FV3 is thought to contribute to their susceptibility. Here we demonstrate that a recombinant *X. laevis* granulocyte colony-stimulating factor (G-CSF) generates PMNs with hallmark granulocyte morphology. Tadpole pretreatment with G-CSF prior to FV3 infection reduces animal kidney FV3 loads and extends their survival. Moreover, G-CSF-derived PMNs are resistant to FV3 infection and express high levels of TNF $\alpha$  in response to this virus. Notably, FV3-infected tadpoles fail to recruit G-CSFR expressing granulocytes into their kidneys, suggesting that they lack an integral inflammatory effector population at this site.

---

#### PRIMARY PRESENTER

---

Daphne Koubourli

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHORS

---

Daphne Koubourli

Leon Grayfer

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Leon Grayfer



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Annotating the Gene *Ci* on the Dot Chromosome of *Drosophila EUGRACILIS*

In many *Drosophila* species, the fourth chromosome is very small and bears relatively few genes. This “dot” chromosome is mostly heterochromatic, has low rates of meiotic recombination, and replicates late in the S phase of mitosis. Despite these hallmarks of suppressed gene expression, genes on the dot chromosome are expressed at normal rates. This unusual pattern piqued the interest of the Genomics Education Partnership (GEP), a research consortium centered in the Biology Department and the McDonnell Genome Institute of Washington University in St. Louis. GEP’s mission is to allow undergraduates to participate in genomics research through course curricula and includes consortium members at over 150 universities. GW students in BISC 2208 Genetics Laboratory learn to annotate genes to improve genomic resources for non-model species, facilitating genomic analysis and leading to a publication. My annotation was focused on the gene *cubitus interruptus (ci)*, which encodes for zinc-finger proteins in the Hedgehog (Hh) signaling pathway. This gene is involved in integumentary system development (cuticle pattern and epidermis formation) and organ formation (eye, heart, and nerves). I began by identifying the correct *D. melanogaster* ortholog and confirming this in *D. eugracilis* using BLAST and RNA-seq evidence. Then, specific isoforms of *ci* were identified, and their exon coordinates, frame, and phases were recorded for all existing unique exons. The corrected exon coordinates were then processed through the Gene Model Checker and assessed for similarity with *D. melanogaster*. Isoform *ci*-PA had small gaps in exons 2, 3, 4, and 6, and *ci*-PB presented small gaps in exons 2, 3, and 5. Isoform *ci*-PC presented gaps in exons 2, 3, 4, and no match in exons 5 and 6. All the exon mismatch corresponds the respective protein alignments. There were mismatches within and at the end of exons, especially in exons 5 and 6. I found substantial evolutionary divergence between *D. melanogaster* and *D. eugracilis* lineages in these exons, accounting for only 77% amino acid similarity overall. These results suggested relaxed selection and lower functional significance in this portion of the protein.

---

#### PRIMARY PRESENTER

---

Yong Kwon

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHOR

---

Yong Kwon

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Mollie Manier

---

# NATURAL SCIENCES AND MATHEMATICS

---



---

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

## Model Selection in the Analysis of Photoproduction Data

Scattering experiments provide one of the most powerful and useful tools for probing matter to better understand its fundamental properties governed by the strong interaction. As the spectroscopy of the excited states of nucleons enters a new era of precision ushered in by improved experiments at Jefferson Lab and other facilities around the world, traditional partial wave analysis methods must be adjusted accordingly. In this poster, we present a rigorous set of statistical tools and techniques that we implemented; most notably, the LASSO method, which serves for the selection of the simplest model, allowing us to avoid over fitting. In the case of establishing the spectrum of excited baryons, it avoids overpopulation of the spectrum and thus the occurrence of false-positives. This is a prerequisite to reliably compare theories like lattice QCD or quark models to experiments. Here, we demonstrate the principle by simultaneously fitting three observables in neutral pion photo-production, such as the differential cross section, beam asymmetry and target polarization across thousands of data points.

---

**PRIMARY PRESENTER**

---

Justin Landay

---

**STATUS**

---

Student – Undergraduate

---

**AUTHORS**

---

Justin Landay

Michael Doring

Cesar Fernandez Ramirez

Bin Hu

Raquel Molina

---

**RESEARCH MENTOR/  
DEPARTMENT CHAIR**

---

Michael Doring



---

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

## Numerical Investigations of Pattern Formation in Binary Systems with Inhibitory Long-Range Interaction

We investigate pattern formation in a two-phase system on a two-dimensional manifold by numerically computing the minimizers of a Cahn-Hilliard-like model for micro-phase separation of diblock copolymers. The total energy of the system includes a short-range term—a Landau free energy and a long-range term—the Ohta-Kawasaki functional. The short-range term favors large domains with minimum perimeter and the long-range inhibitory term favors small domains. The balance of these terms leads to minimizers with a variety of patterns, including single droplets, droplet assemblies, stripes, wiggled stripes and combinations thereof. We compare the results of our numerical simulations with known analytical results and discuss the stability of the computed solutions and the role of key parameters in pattern formation. For demonstration purposes, we focus on the two-dimensional ellipse and three-dimensional triaxial ellipsoid cases, but our methods are general and can be applied to higher genus surfaces and surfaces with boundaries.

---

**PRIMARY PRESENTER**

---

Jiajun Lu

---

**STATUS**

---

Student – Graduate

---

**AUTHOR**

---

Jiajun Lu

---

**RESEARCH MENTOR/  
DEPARTMENT CHAIR**

---

Frank Baginski



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Molecules to Build Quantum Computers

With the development of science, researchers have higher and higher demands on the capacities of computers. As in the motto of the Olympics, we need computers to be “Swifter higher and stronger”. But classical computers have significant limitations. This prompted researchers to propose harnessing the quantum properties of matter to build a better, faster computer—a quantum computer. Such a complex device will be build out of simpler unit—the quantum bits, or qubits for short.

The research in our group is mainly about the synthesis of magnetic molecular qubits. My project is specifically focusing on the synthesis of transition metal complexes and characterization of their properties when the molecules are attached to a single wall carbon nanotube, which will serve as electrical readout of the magnetic qubit state. Some molecules (called spin crossover complexes) containing transition metal cations such as iron and cobalt can present two different spin states, giving them the ability to work as “0” and “1” in binary system. The ligand that I am working on consists of two 1H-pyrazole molecules and one 3-nitropyrazole connected by a boron atom. This ligand is quite interesting because it can give an iron cation spin crossover properties and the nitro group on the backbone of the pyrazole provides opportunities for further functionalization, including attachment to carbon nanotubes.

Furthermore, there are many 1H-pyrazole derivatives, and we not only can use different derivatives to change the properties of the molecules, but we also can change the number of derivatives connected to the boron to give the molecules different functions. Basically, the possibilities of the complexes are countless, which opens the door to a wide range of applications in the future.

---

#### PRIMARY PRESENTER

---

Chenyang Ma

---

#### STATUS

---

Student – Graduate

---

#### AUTHOR

---

Chenyang Ma

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Claire Besson



---

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

## Predicting Bioconcentration Factor Using a Metabolism-Based Quantitative Structure-Activity Relationship Model

The prediction of bioconcentration factor is important for the determination of potential environmental toxicity of new and existing chemical substances. To this end, various *in silico* models for bioconcentration factor have been developed to replace or assist *in vivo* testing, including linear and nonlinear Quantitative Structure-Activity Relationship Models (QSARs). This work is exceptional among these models because it is the first to consider metabolic effects relating to Cytochrome P450 *in fish* a priori to model development as opposed to establishing metabolic explanations for model behavior a posteriori. The model developed here is based on a subset of data from previous work by Dimitrov et al. The final model presented is a two-step process. First, structures are classified into a potential metabolism category using SMARTS patterns encompassing known functional domains metabolized by Cytochrome P450. Then a linear QSAR model utilizing calculated chemical descriptors that is specific to the established potential metabolism category is applied to the compound to predict its bioconcentration factor. Both internal and external validation are carried out for the models of each category and their performance is discussed. It is expected that this metabolism-based QSAR model will find applications in regulatory settings and will be used as a basis for expansion to other chemical classes outside of the applicability domain considered here.

---

### PRIMARY PRESENTER

---

Julia Magliozzo

---

### STATUS

---

Student – Undergraduate

---

### AUTHORS

---

Julia Magliozzo

Nan An

Adelina Voutchkova-Kostal

---

### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Adelina Voutchkova-Kostal



---

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

## An Index for Profitable Trading with Pedagogic Examples

We introduce a new trade index. A trader wins with probability  $1/2$ , stays even with probability  $1/2$ , or loses with probability  $1/2$ , according as whether the index is positive, zero, or negative. We illustrate the utility of the trade index in a few examples, including roulette, binary games, Powerball and stock trading based on exponential moving average. The stock trading example is based on a real data set. We give the trader betting on contracts some guidance on the optimal choice of the proportion of the capital to trade.

---

**PRIMARY PRESENTER**

---

Kai Wang

---

**STATUS**

---

Student – Undergraduate

---

**AUTHORS**

---

Hosam Mahmoud

Talaat Abdin

Kai Wang

---

**RESEARCH MENTOR/  
DEPARTMENT CHAIR**

---

Hosam Mahmoud



---

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

## Recoil Corrections in Antikaon-Deuteron Scattering

Antikaon-deuteron scattering has the key role to pin down the properties of the so important antikaon-nucleon scattering. The latter is one of the longest debated strong interactions channels.

It is studied within the non-relativistic effective field theory (EFT) approach. The largest contribution to the  $K^-d$  scattering length stems from the multiple scattering series with infinitely heavy (static) nucleons. While the leading static contribution is inherently non-perturbative and requires re-summation, the correction to the scattering length due to the nucleon recoil (retardation) effect is amenable to the perturbative treatment with respect to the small parameter  $\xi = MK/mN$ . The first order correction to the  $Kd$  scattering length due to single insertion of the retardation term in the multiple-scattering series is calculated. The leading recoil effect turns out to be reasonably small and contributes less than 10 % to the scattering length.

---

### PRIMARY PRESENTER

---

Maxim Mai

---

### STATUS

---

Postdoctoral Student

---

### AUTHORS

---

Maxim Mai

Vadim Baru

Evgeny Epelbaum

Akaki Rusetsky

---

### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

William Briscoe



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Understanding the Influence of *Synapsin* on Sperm and Seminal Receptacle (SR) Length

The fruit fly *Drosophila* has become a model organism for sexual selection research as a result of its very long sperm, up to 5.8 cm in *D. bifurca*, 20 times longer than the fly itself. Evolution of these giant sperm is driven by interactions with the female's sperm storage organ, the seminal receptacle (SR). In *Drosophila*, females mate with multiple males, generating sperm competition for access to fertilizations. Long sperm outcompete short sperm for fertilization, particularly in long SRs, which thus exert stronger selection on sperm length than shorter SRs. Sperm length and SR length have also been found to be genetically correlated, suggesting that sperm and SR length may be influenced by some of the same genes. The gene *Synapsin* has been identified as a candidate gene involved in sperm length in a previous QTL study. *Synapsin* serves the primary function of mediating synaptic activity through its expression at synaptic terminals, but has been connected to other processes including courtship behavior. The purpose of this research project is to examine the influence of *Synapsin* on the length of sperm and SR in order to verify *Synapsin* function in spermatogenesis and to determine if it also has pleiotropic effects on SR length. Sperm and SR length of *Synapsin* null mutants were measured and compared with a control group. *Synapsin* mutants have decreased bouton formation at neuromuscular junctions, suggesting a positive regulation of synaptic growth. We expect *Synapsin* to also positively regulate sperm length and for *Synapsin* null mutants to have shorter sperm and SRs than controls.

---

#### PRIMARY PRESENTER

---

Isvita Marfatia

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHOR

---

Isvita Marfatia

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Mollie Manier



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Common Agricultural Concentrations of Pesticides, Imidacloprid and Glyphosate, on Viability of Spermatozoa in *Apis Mellifera*

To date, not much research has focused specifically on drone sperm viability, but this paper aims to explore changes in viability of sperm post exposure to both insecticides and herbicides. Direct exposure of sperm to dosages at, or below, the typical agricultural use concentrations of both imidacloprid and glyphosate resulted in greater sperm cell death than compared to control samples. Pesticides (glyphosate or imidacloprid) were separately administered after semen was extracted from drone honeybees. All honeybee sperm samples were collected and diluted in a PBS solution. Varying field-realistic doses of diluted pesticide were administered directly to the sperm samples, followed by propidium iodide dye to selectively stain dead cells and, therefore, assess viability. Images were collected and analyzed using imageJ software to determine a dead to total ratio of sperm. The results show that both imidacloprid and glyphosate may relate to death of sperm. For both pesticides assessed, sperm viability was inversely proportional to the amount of pesticide added. The results showed no significant difference in spermatozoa viability resulting from consumption of imidacloprid by drone honeybees, potentially relating death of sperm to direct pesticide exposure.

---

#### PRIMARY PRESENTER

---

Nico DeFlorio

---

#### STATUS

---

Student – Undergraduate

---

#### CO-PRESENTER

---

Shalini Sudama

---

#### AUTHORS

---

Tara McCloskey

Nico DeFlorio

Shalini Sudama

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Hartmut Doebel



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### The Hunt for Fast Transients in LOFAR's First Large Survey

The search for cosmological transients is entering a new era. The death of massive stars, outbursts from compact objects and other extreme phenomenon present an opportunity to observe high energy events at timescales much shorter relative to the majority of the observable universe. With the rise of a new generation of radio interferometers, observations and techniques once relegated to the x-ray and gamma-ray domains are now available in the lower energy spectrum. Using the Multifrequency Snapshot Sky Survey (MSSS) carried out by the Low Frequency Array (LOFAR), this research aims to discover and document transients and variable sources in the northern hemisphere. In particular, we are exploring transients at minute timescales at low radio frequencies, a part of transient parameter space that has as of yet been largely unexplored. The methodology employed in this project, combined with machine learning techniques, may prove helpful in synthesizing the massive amounts of data to be generated by next generation instruments such as the Square Kilometer Array (SKA).

---

#### PRIMARY PRESENTER

---

Zachary Meyers

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHOR

---

Zachary Meyers

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Alexander van der Horst



---

**COLUMBIAN COLLEGE OF ARTS AND SCIENCES**

---

## The Pole Structure of the $\Lambda(1405)$ in a Recent QCD Simulation

The  $\Lambda(1405)$  baryon is difficult to detect in experiment, absent in many quark model calculations, and supposedly manifested through a two-pole structure. Its uncommon properties made it subject to numerous experimental and theoretical studies in recent years. Lattice-QCD eigenvalues for different quark masses were recently reported by the Adelaide group. We compare these eigenvalues to predictions of a model based on Unitary Chiral Perturbation Theory. The  $U\chi$ PT calculation predicts the quark mass dependence remarkably well. It also predicts the overlap pattern with different meson-baryon components, mainly  $\pi\Sigma$  and  $K^*N$ , at different quark masses, which might help in the construction of meson-baryon operators for improved level detection on the lattice. More accurate lattice QCD data are required to draw definite conclusions on the nature of the  $\Lambda(1405)$ .

---

**PRIMARY PRESENTER**

---

Raquel Molina

---

**STATUS**

---

Postdoctoral Student

---

**AUTHORS**

---

Raquel Molina

Michael Doring

---

**RESEARCH MENTOR/  
DEPARTMENT CHAIR**

---

Michael Doring



---

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

## On Torsion in Khovanov Homology

Khovanov homology, an invariant of knots (or links), is a generalization of the Jones polynomial.  $Z_2$  torsion in the Khovanov homology of links is very common. A finite number of examples of knots with non- $Z_2$  torsion were also known earlier. In this presentation, I will discuss some infinite families of knots and links with non- $Z_2$  torsion. In particular, I will also discuss counter-examples to parts of the PS braid conjecture.

---

**PRIMARY PRESENTER**

---

Sujoy Mukherjee

---

**STATUS**

---

Student – Graduate

---

**AUTHORS**

---

Sujoy Mukherjee

Jozef H. Przytycki

Marithania Silvero

Xiao Wang

Seung Yeop Yang

---

**RESEARCH MENTOR/  
DEPARTMENT CHAIR**

---

Jozef H. Przytycki



---

## CORCORAN SCHOOL OF THE ARTS & DESIGN

---

### Role of Serine Proteases in *Escherichia coli* Pathogenesis

Stress factors and unfavorable conditions in the environment may cause cellular proteins to lose their functions. Proteins located in the outer membranes of the cell are more exposed to stress and therefore have a higher tendency to misfold and lose their functional conformation. Gram-negative bacteria, such as *Escherichia coli*, have evolved protein quality control mechanisms in the periplasm to assist and monitor folding of outer membrane proteins. Serine proteases are cardinal elements of the protein quality control systems. One such serine protease is DegP and in different conditions it functions both as a chaperone and a protease. In addition, it has a role in the virulence of several Gram-negative and Gram-positive bacteria. Other members of the serine protease family also possessing the same proteolytic domain with DegP are DegS and DegQ. Previous studies using the mice model have shown that expression of DegP and DegS increases after the infection with the uropathogenic strain of *Escherichia coli*. Yet, DegQ expression has not been well studied. Our aim is to use *Drosophila melanogaster* as a model organism and identify novel genes taking part in the virulence of the bacteria. Non-pathogenic K12 strain of *E. coli* does not infect adult *Drosophila* flies or larvae; yet it causes a significant decrease in S2 cells survivability and eventually their death. Our aim is to compare the expression levels of DegS, DegP and DegQ genes in both pathogenic and non-pathogenic strains of *E. coli* during infection of S2 cells.

---

#### PRIMARY PRESENTER

---

Yaprak Ozakman

---

#### STATUS

---

Student – Graduate

---

#### AUTHOR

---

Yaprak Ozakman

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Ioannis Eleftherianos



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Regulation of TGF- $\beta$ Signaling in *Drosophila* Following Infection with Parasitic *Heterorhabditis* Nematodes

Parasitic nematodes cause infectious diseases that represent one of the major threats to human health. To understand mechanisms underlying host-pathogen interactions upon these infections, we need to develop proper research tools. The common fruit fly *Drosophila melanogaster* is a well-established invertebrate model system with conserved signaling pathways that underlie innate immune responses. Upon microbial, *D. melanogaster* employs different signaling pathways leading to expression of antimicrobial peptides. However, the response of *D. melanogaster* to nematode infection is not very well characterized. Here, we demonstrate a way to infect adult fruit flies to use this assay to examine a potential role of the TGF- $\beta$  signaling pathway upon parasitic infections. TGF- $\beta$  signaling pathway is an evolutionary conserved pathway that has a role in tissue repair and inflammation in mammals. In *D. melanogaster*, TGF- $\beta$  signaling pathway components modulate the immune response to wounding and bacterial infection. We aim to characterize the fly's immune response to *Heterorhabditis* nematodes and potentially uncover evolutionary conserved mechanisms for anti-nematode immune response.

---

#### PRIMARY PRESENTER

---

Jelena Patrnogic

---

#### STATUS

---

Postdoctoral Student

---

#### AUTHORS

---

Jelena Patrnogic

Ioannis Eleftherianos

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Ioannis Eleftherianos



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Design and Synthesis of Novel Organic Compounds for the Inhibition of DXR from *Mycobacterium tuberculosis*

Tuberculosis (TB), caused by *Mycobacterium tuberculosis* (Mtb), remains one of the world's deadliest infectious diseases, and a significant challenge for new drug discovery and physicians treating these patients. In 2015, an estimated 10.4 million people contracted TB. These patients are commonly treated with a combination of drugs including isoniazid, rifampin, ethambutol, and pyrazinamide. With the emergence of an estimated 480,000 new cases of multi-drug resistant TB (MDR-TB) in 2015, there is a continued need to develop novel therapies to combat the disease. Previous work with natural products fosmidomycin and FR900098 established that blocking DXR inhibits the production of essential isoprenoid precursors in *Plasmodium falciparum*, the causative agent of malaria. DXR is an enzyme involved in the catalysis of the second step in the non-mevalonate pathway (also known as the MEP). A number of important pathogens, including Mtb, utilize this pathway. Humans, however, employ the classical mevalonate pathway, indicating that DXR inhibitors should selectively target bacterial cells over human ones. In this study, we designed and synthesized an alpha-aryl substituted analog of fosmidomycin. The compound design is based on prior work of separate analogs showing the importance of the 3,4-dichlorophenyl at the alpha position and the phenbutanoyl substituent on the amide. The synthetic route to obtain this compound is composed of seven steps, employing both Wittig and reductive amination reactions. The analog will be tested against Mtb DXR and intact mycobacterial cells to determine its efficacy. The results will help determine whether these two structural moieties can be combined, resulting in an inhibitor with increased potency.

---

#### PRIMARY PRESENTER

---

Abigail Pepin

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHORS

---

Abigail Pepin

Cynthia S. Dowd

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Cynthia S. Dowd



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Characterizing the Effects of *Kayak* Knockdown on Post-Copulatory Sexual Selection in *D. Melanogaster*

In *Drosophila*, the lengths of male sperm and female sperm storage organs (seminal receptacle; SR) play major roles in post-copulatory sexual selection (sperm competition and cryptic female choice), are coevolving, and may be involved in rapid evolutionary diversification within and among species. Despite their significance, the underlying genetic mechanisms for sperm and SR length variation are not well understood. Recent work has uncovered a genetic correlation between the two traits, suggesting that they are coevolving under Fisherian runaway sexual selection, as is predicted for pre-copulatory sexual selection on male traits and female preferences for those traits. Previous work identified a number of candidate genes for sperm length using a RAD QTL approach, and we have characterized the phenotypic effects of a *kayak* knockdown in *D. melanogaster* using RNAi. *kayak* is involved in transcriptional regulation and signal transduction during embryonic development; however, it has no known roles in spermatogenesis. Knockdown of *kayak* increased both sperm and SR length, suggesting that the gene acts as a negative regulator for these phenotypes. Although sperm head and tail lengths are not known to be pleiotropic, the sperm head lengths of knockdown males were also significantly longer than those of control males. A decrease in fertility rates was observed, supporting previous evidence of longer sperm delaying reproductive maturity and costing more energy to produce. *kayak* also demonstrates strong allelic divergence between isolines with long and short sperm. The roles of *kayak* in mating and re-mating behavior, sperm competition, and sperm storage ability are currently being investigated through RNAi knockdown. This study is important for understanding the underlying genetic mechanisms of spermatogenesis and sperm storage organ development as well as characterizing molecular mechanisms of Fisherian runaway selection and male-female coevolution.

---

#### PRIMARY PRESENTER

---

Jai Photavath

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHOR

---

Jai Photavath

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Mollie Manier



## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

### Single-Cell Profiling of Dorsal-Ventral Metabolomic Differences in the Vertebrate (Frog) Embryo

Single-cell mass spectrometry (MS) promises to unlock new knowledge on cellular processes underlying the establishment of different types of tissues during early embryonic development. Discovery characterization of metabolites offers a powerful potential to understand how and at what developmental stage of the embryo single blastomeric cells embark on different chemical paths to form these tissue types. Our group recently combined single-cell microsampling with capillary electrophoresis (CE) electrospray ionization (ESI) mass spectrometry (MS) to enable the metabolic analysis of cells in the developing embryo. Here, we utilize this technology to profile, for the first time, the metabolic state of cells while they form dorsal and ventral cell populations in the frog (*Xenopus laevis*), an important model of cell and developmental biology. We used microsampling CE-ESI-MS to measure metabolites in the D1L and V1L cells in the same embryo in a pool of 5 different embryos. This experimental design enabled us to minimize known embryo-to-embryo variability during the collection of metabolomics data, thus facilitating statistical comparison of cells. First, we surveyed the CE-ESI-MS metadata for small molecules. A total of ~200 molecular features (different  $m/z$  and migration time clusters) were found, which likely correspond to metabolites based on the mass, isotope pattern, and migration time of the signals. ~70 of these signals were identified as metabolites based on accurate mass measurements, isotope distribution analysis, tandem mass spectrometry, and comparison of migration times against those of related chemical standards. Next, we generated selected-ion electropherograms for each of these molecular features, resulting in a complex set of metadata that approximated the concentration of metabolites. At present, we are designing multivariate and statistical models to compare the metabolic states of the left ventral and left dorsal cells of the embryo. We will use principal component analysis as an unsupervised tool to compare metabolic profiles between D1L and V1L cells. Next, after median-normalizing the data and calculating the ratios of metabolites, we will perform statistical analysis on the metabolite profiles, using a  $p$ -value (Student's  $t$ -test) less than 0.05 to indicate statistical and a fold change above 1.5 to indicate biological significance. By using this multipronged analytical approach, we expect to be able to identify metabolic signatures that differentiate dorsal-ventral cells in the embryo.

#### PRIMARY PRESENTER

David Plotnick

#### STATUS

Student – Undergraduate

#### AUTHORS

David Plotnick

Rosemary M. Onjiko

Peter Nemes

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

Peter Nemes



---

**COLUMBIAN COLLEGE OF ARTS AND SCIENCES**

---

## Pion-Nucleon Amplitudes for Baryon Spectroscopy

In the search for missing baryonic resonances, many analyses include data from a variety of pion- and photon-induced reactions. For elastic  $\pi N$  scattering, however, usually the partial waves of the SAID or other groups are fitted, instead of data. We provide the partial-wave covariance matrices needed to perform correlated  $\chi^2$  fits, in which the obtained  $\chi^2$  equals the actual  $\chi^2$  up to non-linear and normalization corrections. For any analysis relying on partial waves extracted from elastic pion scattering, this is a prerequisite to assess the significance of resonance signals and to assign any uncertainty on results. The compilation of the necessary data to improve hadronic analyses is presented in detail.

---

**PRIMARY PRESENTER**

---

Joseph Revier

---

**STATUS**

---

Student – Undergraduate

---

**AUTHOR**

---

Joseph Revier

---

**RESEARCH MENTOR/  
DEPARTMENT CHAIR**

---

Michael Doring



## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

### In Vivo Bioluminescence Imaging Reveals a Pre-Hypertensive Surge in Nuclear-Factor- $\kappa$ -B Activity in the Paraventricular Nucleus of the Hypothalamus During Diet-Induced Obesity

Central nervous system (CNS) alterations have been linked to obesity-related cardiovascular and metabolic diseases. Emerging evidence points to activation of brain transcription factors, such as nuclear-factor- $\kappa$ -B (NF- $\kappa$ B), in the pathogenesis of cardiovascular and metabolic disorders. The paraventricular nucleus of the hypothalamus (PVN) is a CNS region involved in both cardiovascular and metabolic control, although the contribution of the PVN to obesity-related disorders remains incompletely defined. With this in mind, we tested the hypothesis that diet-induced obesity is associated with NF- $\kappa$ B activation in the PVN. Male C57B1/6 mice underwent bilateral PVN-targeted injection of an adenovirus encoding firefly luciferase downstream of the NF- $\kappa$ B consensus sequence. With this technique, intraperitoneal administration of the substrate cyclic alkylaminoluciferin (CycLuc1) allows for "real-time" in vivo bioluminescence imaging of PVN NF- $\kappa$ B activity in the same animal over time. Throughout the study, indirect calorimetry was used to evaluate metabolic indices and arterial blood pressure was measured in conscious mice using radiotelemetry. After surgical procedures and a 2-week recovery period, baseline measurements were performed and mice were then placed on a high fat diet (HFD) to induce obesity (60% fat; n=8) or remained on normal chow (5% fat; n=8). PVN NF- $\kappa$ B activity remained at low levels after starting a HFD, but surged by approximately 35% at 3 weeks (day 21;  $1.34 \pm 0.10$  photons/s fold day 0,  $p < 0.05$ ) and remained low for up to 8 weeks of HFD feeding. No changes in PVN NF- $\kappa$ B activation occurred with normal chow feeding. Indirect calorimetry assessments suggested no apparent relationships between the surge in PVN NF- $\kappa$ B activity and metabolic parameters including body weight, food intake, locomotor activity, oxygen consumption, respiratory exchange ratio, and energy expenditure. In contrast, radiotelemetry measurements revealed a slowly developing hypertension in response to HFD, with an initial rise in mean arterial blood pressure at 4 weeks ( $108 \pm 1$  vs.  $116 \pm 1$  mmHg, day 0 vs. day 28,  $p < 0.05$ ) that was sustained for up to 8 weeks ( $117 \pm 2$  mmHg,  $p < 0.05$  vs. baseline). Taken together, these findings indicate a robust and transient surge in NF- $\kappa$ B activity in the PVN during HFD feeding. This transcription factor activation (3 weeks) occurs immediately prior to increases in arterial blood pressure (4 weeks), suggesting that PVN NF- $\kappa$ B activation may contribute to the development of obesity-induced hypertension.

#### PRIMARY PRESENTER

Brandon Ritchie

#### STATUS

Student – Undergraduate

#### AUTHORS

Brandon Ritchie

Hayk Simonyan

Colin N. Young

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

Colin N. Young



---

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

## Disentanglement of Electromagnetic Baryon Properties

Through recent advances in experimental techniques, the precise extraction of the spectrum of baryonic resonances and their properties becomes possible. Helicity couplings at the resonance pole are fundamental parameters describing the electromagnetic properties of resonances and enabling the comparison of theoretical models with data. We have extracted them from experiments carried out at Jefferson Lab and other facilities using a multipole analysis within the Julich-Bonn framework. Special attention has been paid to the uncertainties and correlations of helicity couplings. Using the world data on the reaction  $\gamma\rho\rightarrow\eta\rho$ , we have calculated, for the first time, the covariance matrix. Our results are useful in several ways. They quantify uncertainties but also correlations of helicity couplings. Second, they can tell us quantitatively how useful a given polarization measurement is. Third, they can tell us how the measurement of a new observable would constrain and disentangle the resonance properties which could be helpful in the design of new experiments. Finally, on the subject of the missing resonance problem, model selection techniques and statistical tests allow us to quantify the significance of whether a resonance exists.

---

**PRIMARY PRESENTER**

---

Daniel Sadasivan

---

**STATUS**

---

Student – Graduate

---

**AUTHOR**

---

Daniel Sadasivan

---

**RESEARCH MENTOR/  
DEPARTMENT CHAIR**

---

Michael Doring

---



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Palladium-LDHs as Highly Active Heterogeneous Catalysts in Decarbonylation

Catalytic transformations of biomass-derived materials such as 5-hydroxymethylfurfural (HMF) are becoming increasingly important, and decarbonylation specifically is a highly valuable and thermodynamically challenging reaction to carry out. Developing economical, highly active, and selective catalysts is currently of high interest. Heterogeneous catalysts consisting of Mg-Al-Pd layered double hydroxides (LDH) provide a facile solution in that they are highly tunable and selective. Here we describe the development of these catalysts and the effects of varying percentages of several compatible transition metals, optimized to a selective incorporation of Pd in the cationic layers of the LDH, or as Pd clusters on the surface. We include complete characterizations of the catalysts including XPS, Raman, PXRD, TEM, SEM, FTIR, TGA, ICP-MS, gas adsorption and microcalorimetry. The optimized catalyst is highly selective towards decarbonylation of aliphatic and aromatic aldehydes. The versatility of these catalysts encourages further study of other organic transformations including decarbonylation, dehydrogenation, amine coupling, and additional biomass-conversion reactions.

---

#### PRIMARY PRESENTER

---

Kavya Samudrala

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHORS

---

Kavya Samudrala

Nan An

Adebola Adeniyi

Matt Finn

Paulo Pereira

Adelina Voutchkova-Kostal

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Adelina Voutchkova-Kostal

---

# NATURAL SCIENCES AND MATHEMATICS

---



---

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

## QMP Overexposure Affects the Classical Conditioning of Sting Extension Response in *Apis Mellifera*

The queen mandibular pheromone, produced by the queen bee of the hive, regulates colony behavior and physiology of worker bees. QMP is also artificially generated, commonly used in agriculture to lure bees to crops to aid in pollination. However, QMP overexposure has been shown to compromise *Apis mellifera* memory and learning capabilities and to delay foraging. This study focuses on the effects of artificial QMP overexposure on memory and learning abilities of honey bees. By pairing an odorant with an aversive stimulus, we attempted to classically condition *Apis mellifera* in the presence of different QMP concentrations. Results suggest that QMP affects aversive learning and memory in *Apis mellifera* until the pheromone wears off.

---

**PRIMARY PRESENTER**

---

Kayla Schwartz

---

**STATUS**

---

Student – Undergraduate

---

**CO-PRESENTER**

---

Sophie Jeong

---

**AUTHORS**

---

Kayla Schwartz

Sophie Jeong

Tahlia Price-Rivera

Hartmut Doebel

---

**RESEARCH MENTOR/  
DEPARTMENT CHAIR**

---

Hartmut Doebel



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### The Chick Embryo as a Model for Research on Congenital Disorders of the Vestibular Inner Ear

In congenital disorders affecting the vestibular inner ear, children experience delayed motor development, and posture and balance problems. What happens to the brain regions processing vestibular signals is unknown in these children. We hypothesize that the malformed vestibular inner ear transmits abnormal signals to the developing vestibular nuclei, the first brain centers processing the input. We expect abnormal signals to influence development of the remaining vestibular circuitry from vestibular nuclei in the brainstem to vestibular cerebral cortex.

Our lab is implementing a new animal model, the chick embryo, to study vestibular brain development in congenital disorders because the existing genetic mutant animal model shows a high degree of variability in inner ear pathology, making it unsuitable to analyze brain structure and function. We find that surgical rotation of the developing inner ear, or otocyst, 180 degrees in two-day-old chick embryos results in an abnormal inner ear with similar pathology found in children with congenital vestibular inner ear disorders. The predominant defect is a large sac with truncated or absent canals, while the less frequent pathology is an inner ear with three small canals. Thus, the chick offers a reproducible animal model. After hatching, these experimental chicks show abnormal vestibular-mediated behaviors, including head tilt, stumbling while walking, delayed righting reflex, and a tendency to close one or both eyes.

To begin understanding what happens in the brain due to inner ear pathology, we counted the vestibular nuclei neurons in the chick tangential nucleus after otocyst rotation. We selected the tangential nucleus because its principal cells are distinctive vestibular nucleus neurons aligned in rows between the primary vestibular fibers in the lateral medulla oblongata. We find significant reduction in the number of neurons in the tangential nucleus on the rotated side, with the extent of neuron loss depending on the inner ear pathology. Using the chick model, we will identify the fundamental neural mechanisms operating during the emergence and maturation of vestibular signal processing in these brain networks. Understanding the role of vestibular sensory information in brain development may reveal what goes wrong in central sensory signal processing in children with abnormal vestibular system function due to congenital disorders such as CHARGE syndrome or autism.

---

#### PRIMARY PRESENTER

---

Hayley Seal

---

#### STATUS

---

Student – Undergraduate

---

#### CO-PRESENTERS

---

Sigmund Lilian

Kenna Peusner

---

#### AUTHORS

---

Hayley Seal

Sigmund Lilian

Kenna Peusner

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Kenna Peusner



---

## CORCORAN SCHOOL OF THE ARTS & DESIGN

---

### Modeling the International Links Between Interbank Offered Rates Among Different Markets Through a Wavelet Analysis Approach

This project investigates the links and interactions of the interbank offered lending rates among different types of markets, through the implementation of a wavelet multi-scale approach. The data used includes USD-Libor rate, which is long been well established, CHY-SHIBOR rate and RUB-Mosprime rate. The latter two are relatively new, but already have had close interactions with the USD counterpart because of the globalization of the money and financial markets. In our studies we employ the wavelet multi-scale approach, which has various advantages over a direct application of the traditional econometrics methods. The wavelet approach allows us to decompose the data into multiple (specific) time scales instead of being limited to only the short-run and the long-run scales. The wavelet method provides the unique versatile ability to separate the local dynamics from the global one. We fully exploit in this study the fact that different participants of the market react to changes diversely, however, persistently (within themselves) in terms of time. We perform the wavelet transform on the data using different Daubechies DN wavelet bases. The name of Daubechies bases start with Capital D\_N and follows by a even number N to indicate that the number of non-zero coefficients that are in the corresponding wavelet, or the non-zero support; in other words, this is also related to the smoothness of the wavelet function. In our study we use Matlab to process our data, in which the representation code is 'db(N/2)' for the basis filter D\_N mentioned above. To ensure consistency, we use d(N/2) in our report to represent the corresponding D\_N basis. As a result, we decompose the data into different time scales and then perform the Granger Causality Test. This provides the evidence of causality across different time scales. The wavelet variances are computed in turn to show that the short-term rates are more volatile than the longer-term rates. We also discuss causality between the offered rates from different types of markets and how it varies across different time scales, among other results.

---

#### PRIMARY PRESENTER

---

Shigeng Sun

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHORS

---

Shigeng Sun

Svetlana Roudenko

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Svetlana Roudenko

---

# NATURAL SCIENCES AND MATHEMATICS

---



---

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

## Protein Engineering Using the Sortase A Enzyme to Link Different Combinations of Protein for Structural and Functional Studies

Bioengineering two proteins with different functions is important for synergistic targeting of specific processes in the cell that could be linked to diseases such as cancers. Current approaches require chemical reactions that can be harsh on proteins and for which the yields of linked proteins are very low. We are using an innovative approach in which an enzyme, Sortase A, will link any two proteins with specific sequence signatures at the C- and N-termini with much higher yields. For my project, I will use Sortase A to link two different domains of the human MID1 protein that is important for regulating cell growth and differentiation. Mutations in MID1 cause X-linked Opitz BBB/G syndrome (XLOS), characterized by mental retardation, cleft lip and/or palate, and organ complications. We would like to understand how regions of MID1 interact together including structural and biochemical studies. Sortase A will link two domains of MID1 for NMR structural studies where one domain will be isotopically labeled, allowing us to investigate the structure of one domain at a time within a much larger protein, for which solving the structure is not feasible. This will allow us to understand how XLOS-observed mutations affect regions of MID1 that otherwise cannot be accomplished with other techniques. The domains I will link will also be used to target MID1 to a specific anti-cancer pathway.

---

**PRIMARY PRESENTER**

---

Annie Syed

---

**STATUS**

---

Student – Undergraduate

---

**AUTHORS**

---

Annie Syed

Katherine Wright

Michael Massiah

---

**RESEARCH MENTOR/  
DEPARTMENT CHAIR**

---

Michael Massiah



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Synthesis of Potential Anti-Malarial Agents: 4-Iodo-Isohistidine and 4-Iodo-Isohistamine

Malaria is one of the leading causes of disease-related deaths in the world, killing millions each year. Plasmodium Falciparum, perhaps the most deadly of the malaria parasites, has continued to grow more and more resistant to current anti-malarial drugs. P. Falciparum has been found to contain multiple proteins with regions rich in the amino acid histidine, some of which were found as nodules on infected red blood cell membranes. Iodinated histidine and histamine (2-iodo-histidine and 2-iodo-histamine) were shown to have an anti-malarial property by preventing the transport of several malarial proteins in red blood cells. However *in vivo* the iodinated compounds were deiodinated back to histidine and histamine most probably by glutathione, a thiol containing protein found in the body. Models of the 2-iodo-isohistidine and 4-iodo-isohistidine were tested against a model of the thiol. It was found that the 4-iodo-isohistamine/histidine model survived the reaction without loss of the iodide group, indicating its potential as a viable anti-malarial agent. For this project we are interested in taking the concept to the next level by preparing the two substituted analogs of histidine and histamine, iodinating them and testing the products' stability to glutathione.

---

#### PRIMARY PRESENTER

---

Fahim-Faraaz Syed

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHORS

---

Fahim-Faraaz Syed

Michael King

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Michael King



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Changes in Expression of *Photorhabdus Lux* Genes upon Infection of *Drosophila Melanogaster*

Bacteria belonging to the *Photorhabdus* genus, when introduced into *D. melanogaster*, produce a cocktail of virulence factors and toxins that eventually kill the insect host. While all three *Photorhabdus* species—*Photorhabdus temperata*, *Photorhabdus luminescens* and *Photorhabdus asymbiotica*—are entomopathogenic, *Photorhabdus asymbiotica* has been found to be pathogenic to humans as well. My study involves *P. luminescens* and *P. asymbiotica* bacteria. It has been found that *Photorhabdus* undergoes changes in gene expression as a result of its interaction with the insect host. The exact genes involved are not yet known but it has been speculated that the *luxR* gene of the *lux* operon plays a role in the interaction with the host immune response. This study examines the genetic changes that occur in the pathogenic bacteria upon infection both *in vitro* and *in vivo*. The flies and S2 cells are infected with *P. luminescens* and *P. asymbiotica* and the samples are frozen at specific time points. RNA is extracted from the frozen samples of infected flies and cells and then cDNA is synthesized. The results are analyzed using quantitative PCR to examine the expression levels of *lux* genes at different time points.

In addition, *P. asymbiotica* thrives at both 30°C and 37°C and thus is pathogenic to both humans and insects. *P. asymbiotica* has been found previously to produce different virulence factors at each temperature. This study also examines the pathogenicity of *P. asymbiotica* bacteria grown at two different temperatures as well as the immune response of the host to the infections. Preliminary results have shown that flies infected with *P. asymbiotica* grown at 30°C die faster than flies infected with *P. asymbiotica* grown at 37°C. RNA will be extracted from the infected fly samples and quantitative PCR analysis will shed light on the changes in gene expression of the bacteria as well as the defense mechanisms of the host in response to this interaction.

---

#### PRIMARY PRESENTER

---

Nkechi Uzoukwu

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHOR

---

Nkechi Uzoukwu

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Ioannis Eleftherianos



---

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

## Pattern Formation: On the Modeling of Multi-Constituent Inhibitory Systems

Skin pigmentation, animal coats and block copolymers, which can be considered as multi-constituent inhibitory systems, are all around us. Theoretical analysis and numerical simulation of multi-constituent inhibitory systems will be provided here. An inhibitory system is studied as a nonlocal geometric variational problem. The free energy of the system is the sum of two terms: the total size of the interfaces separating the constituents, and a longer ranging interaction energy that inhibits micro-domains from unlimited growth. We establish that in different parameter ranges there are corresponding assemblies of certain patterns that exist as the stationary sets of the free energy functional. Numerically, a diffusive interface model is proposed and many self-assembly processes, which form various patterns, are vividly showed here. Different numerical schemes are compared and a new technique is introduced to be consistent with the Euler-Lagrange equation in the sharp interface model.

---

**PRIMARY PRESENTER**

---

Chong Wang

---

**STATUS**

---

Student – Graduate

---

**AUTHORS**

---

Chong Wang

Yanxiang Zhao

Xiaofeng Ren

---

**RESEARCH MENTOR/  
DEPARTMENT CHAIR**

---

Xiaofeng Ren



---

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

## Relation Between Khovanov Homology and Hochschild Homology

Relation between Khovanov homology and Hochschild has been established through the (partial) isomorphism between chromatic homology of polygon and Hochschild homology of certain algebra. The proof is implicit, and it is interesting to see a constructive proof. We will show a direct proof and seeking for more relations and structures.

---

**PRIMARY PRESENTER**

---

Xiao Wang

---

**STATUS**

---

Student – Graduate

---

**AUTHORS**

---

Xiao Wang

Jozef H. Przytycki

---

**RESEARCH MENTOR/  
DEPARTMENT CHAIR**

---

Jozef H. Przytycki



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Defining the Roles of Antiviral Interferon Cytokines During Amphibian (*Xenopus Laevis*) Immune Responses to the Frog Virus 3 Ranavirus

Increasing prevalence of amphibian infections by the Frog Virus 3 (FV3) ranavirus is significantly advancing the amphibian declines. Notably, antiviral interferon (IFN) cytokines are pivotal to vertebrate antiviral immunity, including those of the amphibian *X. laevis*. In fact, amphibians are the lowest vertebrates to encode type I and type III IFN families. We have previously demonstrated that adult *X. laevis* respond to water bath FV3 infections exclusively with a skin type I IFN response, whereas FV3-challenged tadpoles upregulated their skin gene expression of a type III IFN in response to this virus. To expand on these findings, we examined FV3-infected tadpole and adult *X. laevis* for their gene expression of the type I and III IFNs in their kidneys, which represent principal sites of FV3 replication, and their spleens, which serve as their central immunological organ. Our findings provide a comprehensive perspective of the *X. laevis* antiviral immune responses following FV3 infections and offer new insights into the types of IFNs being utilized by tadpoles and adult frogs within critical immunological sites. Gaining further understanding of the roles of type I and III IFNs during amphibian antiviral responses will broaden our perspectives of the evolutionary origins of these immune mediators and possibly open new avenues by which to eliminate the pathogenic contributions to the amphibian declines.

---

#### PRIMARY PRESENTER

---

Emily Wendel

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHORS

---

Emily Wendel

Leon Grayfer

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Leon Grayfer

---

# NATURAL SCIENCES AND MATHEMATICS

---



---

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

## Mixed Evidence for Ecological Risk Aversion in Juvenile Wild Chimpanzees (*Pan Troglodytes Schweinfurthii*) at Gombe National Park, Tanzania

The ecological risk aversion hypothesis (ERAH) proposes that prolonged primate juvenescence is a response to predation and starvation risks. To avoid predation, juveniles maintain close proximity to adults, increasing competition and limiting foraging efficiency. Slow growth minimizes juveniles' metabolic needs, diminishing subsequent starvation risk. However, past studies investigating the ERAH in wild primates have yielded mixed results. Here, we use 26 months of observational data from Gombe National Park, Tanzania to test the ERAH in wild chimpanzees by comparing the time juveniles spent in close proximity to conspecific adults while feeding and resting. Because predation risks theoretically decrease with increased body size, we predict that juvenile proximity to adults will decrease as they age. Additionally, we expect juveniles to spend more time in close proximity to adults while feeding and resting terrestrially than arboreally because the ground likely poses higher predation risk. Contrary to our predictions, juvenile proximity to adults increased with juvenile age ( $F_{1,12,21}=15.12$ ;  $p=0.02$ ). However, supporting our predictions, juveniles spent more time in close proximity to adults while resting terrestrially than arboreally ( $F_{1,52,97}=7.51$ ;  $p=0.01$ ), but not while feeding ( $F_{1,51,97}=1.08$ ;  $p=0.30$ ). This pattern suggests that resting may be riskier than feeding, when individuals are upright and may be more vigilant for conspecific competition and predators. Other factors, such as social opportunities and resource distribution, may also contribute to patterns of juvenile proximity to adults.

---

**PRIMARY PRESENTER**

---

John Winans

---

**STATUS**

---

Student – Undergraduate

---

**AUTHORS**

---

John Winans

Kaitlin Wellens

Elizabeth Lonsdorf

Carson Murray

---

**RESEARCH MENTOR/  
DEPARTMENT CHAIR**

---

Kaitlin Wellens



---

## SCHOOL OF ENGINEERING AND APPLIED SCIENCE

---

### The Second-Order Acoustical Nonlinearity Parameter B/A of Bubbly Liquids

The presence of bubbles in the liquid introduces dispersion, increased attenuation and nonlinearities in the medium (bubbly liquid). The second-order acoustical parameter B/A describes the nonlinearity of the bubbly liquid. Here, we propose a new theoretical formula for the evaluation of the nonlinearity parameter B/A of bubbly liquids.

The nonlinear parameter B/A is an important property for characterizing different media and materials, and also important for ultrasound imaging. It can be derived from the equation of state of a fluid using the Taylor expansion to the second order. B/A has been studied extensively in industrial, chemical and biological fluids since Beyer proposed this thermodynamic technique. However, we will show that certain important aspect for this criterion remains unexplored for bubbly liquid. Here, we develop a new formula based on the thermodynamic method which correlates both attenuation and phase velocity of ultrasound waves in liquids containing free or encapsulated microbubbles. These quantities can be measured directly using a broadband technique. It offers a simple workable approach for calculating B/A from the experimental data. The result indicates a finite value of the nonlinearity parameter B/A regardless of increasing bubble volume fractions.

---

#### PRIMARY PRESENTER

---

Lang Xia

---

#### STATUS

---

Student – Graduate

---

#### AUTHORS

---

Lang Xia

Krishna N Kumar

Kausik Sarkar

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Kausik Sarkar



## SCHOOL OF ENGINEERING AND APPLIED SCIENCE

### Computational Discovery of Silicon Helium Compound

Silicon plays a central role in semiconductors and photovoltaic solar cells thanks to its abundance in earth mantle and its valuable electronic properties. However the indirect electronic band gap of the diamond cubic silicon limits its broader applications for optical/solar applications. Intriguingly, silicon also possesses a rich free-energy landscape with many local minima, and a large number of metastable allotropes emerge when pressure and temperature are extended beyond ambient conditions. These allotropes, if synthesized under extreme conditions, may also be kinetically stabilized under ambient condition, thus allowing further exploration of their novel properties. One type of such novel allotropes, silicon clathrate, exhibits promising optoelectronic properties for its quasi-direct electronic band gap. Unfortunately silicon clathrate has only been synthesized with inevitable contaminations from accompanying alkali atoms that undermine its electronic property merits through excessive doping. A new route to the silicon clathrate formation has long been sought, and only for the first time realized in our molecular dynamics simulation that shows inert gas atoms, such as Helium, are capable of inducing the nucleation of silicon clathrate with an experimentally practical formation rate. Strikingly, our study also predicts the formation of an unconventional, new silicon helium compound, considering that helium is chemically inert due to the closed-shell electronic configuration. Remarkably, the new compound was also predicted to possess a direct electronic band gap, a key electronic property allowing for optoelectronic applications. A close examination reveals the silicon-helium compound features the normal hexagonal silicon crystal framework encapsulating large amount of helium atoms in very tight lattice interstices. The structures of the new compound were verified and optimized at state-of-art quantum chemistry level, and was found to bear 4% tensile strain to the silicon crystal framework, a significant amount that usually fails realistic materials. Furthermore, detailed nucleation simulations and thermodynamic property calculations have demonstrated the stability of the new silicon-helium compound near ambient conditions, thus suggested a feasible experimental route for synthesis. The effectively negative pressure exerted by the inclusion of Helium could also inspire new ideas of mechanical treatments of solid materials.

#### PRIMARY PRESENTER

Enshi Xu

#### STATUS

Postdoctoral Student

#### CO-PRESENTER

Tianshu Li

#### AUTHORS

Enshi Xu

Yuanfei Bi

Tianshu Li

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

Tianshu Li



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Transcriptomic Analysis of the *Drosophila Melanogaster* Response to the Entomopathogen *Steinernema Carpocapsae*

*Drosophila melanogaster* is an outstanding model to study the molecular and functional basis of host-pathogen interactions. Currently our knowledge of microbial infections in *D. melanogaster* is well understood, however the response of flies to nematode infections is still in its infancy. Here we have used the potent parasitic nematode *Steinernema carpocapsae* that lives in mutualism with its endosymbiotic bacteria *X. nematophila* to examine the transcriptomic basis of the interaction between *D. melanogaster* and entomopathogenic nematodes. We have employed next generation RNA-sequencing to investigate the transcriptomic profile of *D. melanogaster* larvae in response to infection by *S. carpocapsae* symbiotic (carrying *X. nematophila*) or axenic (lacking *X. nematophila*) nematodes. Bioinformatic analyses have identified the strong induction of genes that are associated with the peritrophic membrane, stress response as well as several genes that participate in developmental processes. We have also found that distinct types of genes are enriched in *D. melanogaster* larvae responding to either symbiotic or axenic nematodes. We further found that while symbiotic nematode infection enriched certain known immune-related genes, axenic nematode infection enriched several genes associated with chitin binding, lipid metabolic functions and neuroactive ligand-receptors. In addition, we have identified genes with potential role in nematode recognition and genes with potential anti-nematode activity. Findings from this study will undoubtedly set the stage for identifying key regulators of anti-nematode immune mechanisms in *D. melanogaster* as well as in other insects of socioeconomic importance.

---

#### PRIMARY PRESENTER

---

Shruti Yadav

---

#### STATUS

---

Student – Graduate

---

#### AUTHORS

---

Shruti Yadav

Sean Daugherty

Amol Shetty

Ioannis Eleftherianos

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Ioannis Eleftherianos



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Human Amylin Modulates the Phosphorylation State of ERK-Kinase in Pancreatic Beta Cells

Type-2 diabetes mellitus (T2DM) is characterized by the loss of pancreatic  $\beta$ -cells and insufficient insulin production and secretion in response to elevated blood glucose levels. Previous research implicates the misfolding and aggregation of islet amyloid polypeptide (IAPP) or human amylin (hA), a 37 amino acid pancreatic peptide hormone, as main culprit in  $\beta$ -cell demise. This study examines the potential regulatory role of extracellular signal-regulating kinase 1/2 (ERK-1/2) in IAPP toxicity. Proliferative kinases ERK-1/2, as well as Src kinase, fulfill a pro-survival role in cells. Thus, during exposure to stress one could presume that said kinases will be activated to counteract the detrimental effect of stress on the cell. To test this, the first set of studies aimed at identifying and characterizing the activation pattern of ERK-1/2 and Src kinase in response to exogenous treatment with toxic IAPP concentrations (30  $\mu$ M). In parallel with IAPP, pancreatic rat insulinoma (RIN-m5F)  $\beta$ -cells were treated with  $H_2O_2$  and thapsigargin (TG), which induce oxidative and ER stress in cells, respectively. Cells were then assessed for phosphorylation states of ERK1/2 and Src kinase, reflecting their activation, by western blot analysis. Time-lapse western blot analysis revealed a biphasic pattern of ERK phosphorylation by IAPP: an early phase with an upregulation around 30min, and a second sustained phase of ERK activation ( $>6h$ ). It is known that transient ERK activation underlies the proliferative process in cells, where sustained ERK activation is generally detrimental to cells. Hence, the observed biphasic ERK-1/2 signaling cascade may initially protect  $\beta$ -cells from IAPP insult, but act pro-apoptotically in response to prolonged hA induced stress.

Taken together, these findings suggest that while ERK-1/2 and Src generally serve proliferative and pro-survival roles in eukaryotic cells, they may also exert an opposite (apoptotic) effect under stress conditions induced by IAPP. Supporting this idea, prolonged hA-induced ERK-1/2 and Src kinase activation coincided with TG and  $H_2O_2$  induced cellular stress revealed by Bip, caspase 3, and PARP cleavage. Current and future findings from this study will be critical in understanding the regulatory role of ERK-1/2 in IAPP induced cytotoxicity, which bears importance for understanding the biology of stress in pancreatic cells.

---

#### PRIMARY PRESENTER

---

Noor Zaghlula

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHORS

---

Noor Zaghlula

Aleksandar Jeremic

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Aleksandar Jeremic



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Methods in Sample Delivery for X-Ray Free Electron Laser Studies

The X-Ray Free Electron Laser (XFEL) is an ultra-bright X-Ray that produces pulses that are  $10^{-15}$ s in duration and have a wavelength of  $10^{-10}$ m. XFELs can help elucidate many important biological structures, such as protein structures, through analyzing the X-Ray diffraction patterns produced by a sample. Due to the short wavelength of the XFEL, information about structure can be observed on the atomic level. In biology, understanding the structure always helps understand its function. Thus, optimizing sample delivery methods to achieve the clearest diffraction patterns and more usable data will give the most information for the structure of the sample. For protein fibers, like amyloid, the more aligned the fibers are, the clearer the diffraction patterns will be. To achieve alignment, magnetic nanoparticles were attached to protein fibers and then placed in a high power magnetic field of 2T. This method utilizes the power of the magnetic force to cause the protein fibers to line up in one, uniform direction in a regular, ordered pattern. Amyloid protein fibers were placed on glass slides or a layer of graphene to ascertain whether the surface could help further enhance protein fiber alignment. The results were observed with Atomic Force Microscopy (AFM) and Scanning Electron Microscopy (SEM). Protein crystals are also common samples in XFEL studies. However, determining the actual structure from their diffraction patterns requires cumbersome data analysis processes. Thus, there is a lot of interest in streamlining this process. One way to achieve this is by size sorting the protein crystals. This was achieved using High Performance Liquid Chromatography with a Force Field Focus (FFF) channel. The FFF channel works by settling a sample in suspension in the channel and then applying a crossflow field to sort the sample by size. In order to achieve the best separation, the length and speed of the protocol had to be adjusted for various steps. In the end, the resulting liquid chromatogram showed that the crystals were sorted by size. Overall this study has developed techniques to achieve more useful data for XFEL studies for both protein fibers and crystals.

---

#### PRIMARY PRESENTER

---

Kara Zielinski

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHORS

---

Kara Zielinski

Carolin Seuring

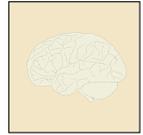
Eleftheria Filippaki

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Mark Reeves



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Reinforcement Sensitivity Moderates the Relationship Between Stressor Exposure and Anxiety

#### INTRODUCTION

According to the American College Health Association (2014), anxiety disorders affect 21.8% of college students, surpassing depressive disorders as the most widespread mental health concern in this population. Exposure to stressful life events (SLE) can greatly exacerbate the chances for the development of anxiety symptoms. However, this is not a pathognomonic association, and much more likely constitutes a diathesis-stress response. The Reinforcement Sensitivity Theory of Personality (RST) provides one potential diathesis-stress explanation for understanding the underlying mechanisms of anxiety disorders. In RST, individuals' response to threatening or aversive stimuli are facilitated by the Fight-Flight-Freeze System (FFFS). Based on the RST theory, it was hypothesized that FFFS and SLE scores would positively predict symptoms of anxiety.

#### PROCEDURE

Undergraduates attending a private urban university (N=341) completed a battery of self-report measures through a secure online survey platform (Qualtrics) at two time-points, which were approximately four weeks apart. The self-reported measures participants completed included the Revised-Reinforcement Sensitivity Theory Questionnaire (rRSTQ; Reuter, Cooper, Smillie, Markett, & Montag, 2015), which includes a FFFS subscale, the College Undergraduate Stress Scale (CUSS; Renner & Mackin, 1998) to measure SLE, and the Beck Anxiety Inventory (BAI; Beck, Epstein, Brown, & Steer, 1988) to measure the anxiety levels of the participants.

#### RESULTS

A linear regression analysis replicated past research showing significant main effects of FFFS Sensitivity and SLE at T1 ( $F=4.86, p<.05$  and  $F=3.92, p<.05$  respectively) on change in panic scores from T1 to T2. In addition, higher FFFS Sensitivity interacted with SLE when predicting change in panic ( $F=4.8, p<.05$ ). At higher levels of FFFS, there was a stronger positive relationship between SLE exposure and anxiety symptoms.

#### DISCUSSION

These preliminary findings are consistent with the literature on the RST and provide further evidence that individual sensitivity and punishment may confer risk towards the development of anxiety disorders. Future analyses will examine the relationship between the RST complex, sociodemographic factors and their effects on panic outcomes. Ultimately, these findings have long-term implications for the prevention and treatment of anxiety disorders.

#### PRIMARY PRESENTER

Kelvin Adom

#### STATUS

Student – Undergraduate

#### AUTHORS

Kelvin Adom

Nicholas Talisman

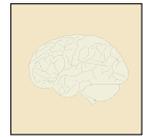
Sage Hess

Kara Meadows

Cynthia Rohrbeck

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

Cynthia Rohrbeck



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Marijuana Use Motives among College Student Users and Non-users

The current study examined motives for marijuana use among college student users and nonusers. As part of a larger survey on marijuana cognitions and behavior, students (N=402) were asked to list up to six possible reasons that they might use marijuana in the future. Two independent raters coded the qualitative responses based on a revised version of the Marijuana Motives Measure (Simons, et al., 1998) and came to consensus where there were discrepancies. Unsurprisingly, those who had used marijuana before reported significantly more motives to use marijuana (M=3.57) than those who had not (M=2.83,  $p < 0.05$ ). The three most common motives reported by users were social reasons, to relax, and because they enjoyed the feeling of being high. Analyses revealed that these three motives were reported significantly more often among users than non-users ( $ps < .05$ ). Participants who had used before were also more likely to say that they would use to enhance or enrich specific experiences, to sleep, to eat, because they were bored, because they believed marijuana to be safer than other substances, and because they had easy access to marijuana, compared to those who had never used before (all  $ps < .05$ ). For participants who had never used marijuana, the most common motives to ever use were to experiment, to cope with stress, and social conformity. However, experimentation was the only one of these motives that non-users reported more frequently than users. *Regular* users (participants reporting they had used in the past 30 days), were more likely than non-regular users to say that they would smoke for social reasons, to regulate their emotions, to relax, because they believed marijuana to be safer than other substances, and because they had easy access to marijuana (all  $ps < .05$ ). The non-regular users were more likely to say that they would use for experimental reasons and because they were already using some other substance at the time ( $ps < .05$ ). These findings shed light onto why college students might start and continue using marijuana.

---

#### PRIMARY PRESENTER

---

Julia Aspelund

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHORS

---

Julia Aspelund

Charlotte Hagerman

Michelle Stock

Tonya Dodge

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Michelle Stock



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Re-Examining the Affective Tipping Point

In an attempt to better understand the dynamics of voter decision making, this project reexamines the affective tipping point, described as the moment where anxiety pushes voters to reconsider their opinion of a candidate. The tipping point is expected to be reached when large amounts of negative information on an object compel an individual to reevaluate their judgement. Most importantly, this theory suggests that anxiety is the predominant factor which leads to information seeking and improved decision making. However, my own observations have led me to suspect that anxiety does not always compel individuals to actually act on that first product, to seek out new information. Instead, at times, anxiety seems to drive individuals to become enveloped in their fears and stagnant in searching for answers. It seems that our most recent election has brought my stance into plain view. This study utilizes an online-experiment to explore whether learning that a preferred partisan candidate who does not share the voter's issue position will always produce anxiety, information search and improved decision-making in said voter. Participants will be introduced to two congressional candidates during my study; they will learn about the candidates' respective platforms and be asked to identify a preferred candidate. Next, the participant will be randomly assigned to learn additional information about their preferred candidate that is either congruent or incongruent with the party of that candidate. Last, they will be given the opportunity to view additional information and be asked to place their vote. While the existence of a tipping point in theory suggests that voters can hurdle disconfirming information, the affective tipping point may not be as constructive to voters in practice as some scholars currently propose.

---

#### PRIMARY PRESENTER

---

Vanessa Bajko

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHOR

---

Vanessa Bajko

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

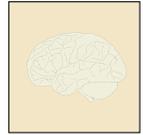
---

Kim Gross

---

# SOCIAL SCIENCES

---



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### “I’m Just Using Everything at My Disposal”: A Qualitative Analysis of the Narratives Surrounding Prescription Stimulant Misuse on College Campuses

A recent spike in the misuse of prescription stimulant medication among young adults has raised cause for concern on many college campuses, as this growth has been attributed to an increasing number of prescriptions being written by physicians as well as individuals turning away from ‘street drugs’ in favor of ‘study drugs’, or stimulants. This research study uses a narrative lens to investigate how college students create meaning for this phenomenon. The findings of in-depth interviews and focus groups revealed that college students base their validation of prescription stimulant misuse on the social norms they perceive on campus, as well as by constructing different narratives derived from their personal experiences. First, respondents used the ease of accessibility to prescription stimulants on campus as a means for justifying consumption as the social norm at their respective schools. Students also validated the illegal consumption of prescription stimulant medication if this behavior was associated with academic pressure, poor time management techniques, and other stressors; challenges that prescribed users are able to identify with. Lastly, prescribed stimulant users and illegal stimulant users developed alternative narratives to substantiate their consumption, each group illustrating their experiential differences through the use of distinct terminology to eliminate any cognitive dissonance.

---

#### PRIMARY PRESENTER

Gretchen Bauermeister

---

#### STATUS

Student – Undergraduate

---

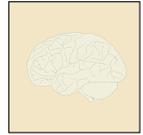
#### AUTHOR

Gretchen Bauermeister

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

Jean Miller



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Potential Savings from Implementing Placebo Controlled Dose Reduction in Psoriasis Treatment

Placebo-controlled dose reduction (PCDR) has the potential to limit topical corticosteroid consumption and expenditure for patients suffering from mild to moderate psoriasis. However, there has been little research into the potential economic benefits of widespread treatment adoption. This study analyzes data representing 2.8 million adults in the 2011-2014 Medical Expenditure Panel Survey to estimate the potential savings in direct out-of-pocket and insurance costs for topical corticosteroids if current dosing regimens were replaced with PCDR. Total mean savings were as high as \$225 per person (95% confidence interval [CI], \$185-\$265) for adults under the age of 65, and up to \$175 (95% CI, \$89-\$261) for adults at least 65. Total savings in these age groups over the four-year period total \$420 million (95% CI, \$342-\$502 million) and \$140 million (95% CI, \$65-\$215 million) respectively. While widespread adoption of PCDR would provide limited out-of-pocket expenditure savings, there would be significant savings for private and public insurance expenditure. Further study of how the price reduction will impact pharmaceutical prices and markets will clarify the intervention's economic impact.

---

#### PRIMARY PRESENTER

---

Daniel Bernstein

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHOR

---

Daniel Bernstein

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

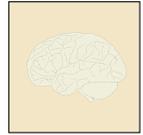
---

Marshall Alcorn

---

# SOCIAL SCIENCES

---



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### The Relationship Between Employee Work/Life Programs and Job Satisfaction

Previous research has noted that work/life balance programs help employees manage their personal and professional obligations, oftentimes making employees more satisfied with their overall work experience. However, most of the research regarding work/life balance programs focuses on the private sector. By analyzing survey responses from 421, 748 federal government employees, I explore the effect of wellness programs, flexible work arrangements, and telework programs on job satisfaction within the federal workforce. More specifically, I examine levels of job satisfaction amongst employees who are offered these types of programs as well as those who participate in them. Since telework is underrepresented in the existing body of research, telework and its effect on job satisfaction is also analyzed in depth. A discussion of my results as well as practical implications for public sector organizations are provided.

---

#### PRIMARY PRESENTER

---

Ian Blaustein

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHOR

---

Ian Blaustein

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

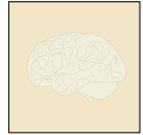
---

Jonathan Mote

---

# SOCIAL SCIENCES

---



---

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

## Power Through Choice: The Legal Rhetoric of Reproductive Rights in the Supreme Court

The Supreme Court of the United States has unparalleled influence on justice in legislation. The Court's decisions have fostered, constrained, and introduced evolution in American law and society throughout the decades, and some cases have rooted themselves firmly in history by setting legal precedence and sparking social change. The landmark *Roe v. Wade* 1973 decision on reproductive rights marked a significant shift in the arguments surrounding the legalization of abortion by re-framing the discussion to highlight rights and privacy-based arguments. Analysis of the language and arguments used in Supreme Court decisions not only explain the legal grounds for the decision, but how the Court views the role of legislation in women's health. Within the writings and arguments of the Supreme Court are the fundamental assumptions and power structures that the Court uses to define justice. Judicial decisions that grant reproductive rights by viewing women as victims or by empowering physicians' right to determine viability of the fetus place a legal Band-Aid over a complex conversation about the morality of regulation on women's' bodies.

This study explores the dominant narratives within the 2016 *Whole Woman's Health v. Hellerstedt*, 2007 *Gonzales v. Carhart*, and 1992 *Planned Parenthood of Southeastern Pennsylvania v. Casey* decisions and argument transcripts in order to compare the rhetoric used over time, using argumentation and dramatic theory to identify the warrants and agencies within the Court's decisions and ultimately the underlying assumptions and actors within this logic. These three cases not only represent two decades of political change and public debate on abortion, but also varying opinions from the Court on limiting or upholding *Roe v. Wade's* precedent.

The study expands upon the comprehensive analysis done on abortion rhetoric in America following the landmark *Roe v. Wade*, and uses a comparative lens to explore how changes in discourse might foster divisive, uncooperative approaches. The study looks for rhetorical patterns and changes of agency in arguments from 1992 *Planned Parenthood of Southeastern Pennsylvania v. Casey* to 2016 *Whole Woman's Health v. Hellerstedt*.

---

**PRIMARY PRESENTER**

---

Madeline Bronstein

---

**STATUS**

---

Student – Undergraduate

---

**AUTHOR**

---

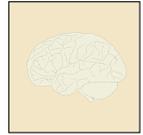
Madeline Bronstein

---

**RESEARCH MENTOR/  
DEPARTMENT CHAIR**

---

Jean Miller



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Risk-Aversion in Wild Juvenile Chimpanzee Feeding Behavior

The extended juvenile period (defined as the age of weaning until sexual maturation) in primates is an important part of development, as this is the time in which individuals acquire the necessary adult skills important in complex social and ecological environments. A juvenile animal's small size and inexperience affect the animal's ability to forage efficiently for food and as such, may face higher predation and starvation risk. Risk in a foraging context arises from variance in food item abundance, diversity, and spatial and temporal distribution of food items. Juvenile animals may socially learn from conspecifics how to obtain, process, and consume food items. In primates, due to the nature of extended maternal care, the mother may serve as the primary source of information. In this study, we examined the influence of risk on the development of feeding behaviors in wild chimpanzees at Gombe National Park in Tanzania. We predicted We predicted that in riskier situations, that is when juveniles have just been weaned or when food is less abundant during the dry season, juvenile feeding would be more similar to their mothers in that mothers and offspring would spend more time co-feeding. Using 34 years of long-term data, we found no relationship between time spent co-feeding and season ( $F_{1,818} = 1.24, p = 0.27$ ), which was inconsistent with our prediction, but offspring age significantly predicted co-feeding ( $F_{1,818} = 9.76, p = 0.002$ ). The increase with age may just reflect increase energetic demands as juveniles age. Together, our results suggest that chimpanzee juveniles are meeting their nutritional and/or energetic needs without matching their mother's behavior. While the fact that chimpanzee juveniles continue to travel with their mothers indicates continued maternal influence on juveniles' access to food resources, chimpanzee juveniles likely have different nutritional and social requirements than their mothers that can be met by budgeting their feeding time differently.

---

#### PRIMARY PRESENTER

---

Marianne Bujacich

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHORS

---

Marianne Bujacich

Kaitlin Wellens

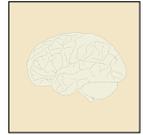
Carson Murray

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Carson Murray



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Unwanted Sexual Contact and the Implicit Objectification of Women

Unwanted sexual contact is a widespread problem in the United States, with 18.5 percent of women and 5.8 percent of men within the general population reporting experiencing forced sex in their lifetime (Black, Basile, Breiding, Smith, Walters, Merrick & Stevens, 2011). Despite initial beliefs that the root causes of perpetration of unwanted sexual contact were misunderstandings about consent, uncontrollable sex drives, or feelings of entitlement, recent studies show that such contact is due to the perpetrator's latent association of the victimized group with nonhuman characteristics. Two studies have linked the objectification of women with increased sexual violence (Polaschek & Ward, 2002; Rudman & Mescher, 2012), offering evidence that suggests a link between seeing women as objects and the perpetration of unwanted sexual contact. However, research to date has been limited to exploring the links between objectification and hypothetical perpetration of unwanted sexual contact, and there is a lack of research on the link between objectification of women and actual perpetration of unwanted sexual contact.

The purpose of this study is to explore the relationship between potential implicit objectification of women and the perpetration of unwanted sexual contact among young adult men. Implicit objectification refers to the immediate, involuntary association of a certain gender with traits more descriptive of an object than of a human. Unwanted Sexual Contact in this context is any sexual act ranging from verbal harassment to rape. This study uses two survey instruments: the Implicit Association Test on the association of genders with humans or objects (Rudman & Mescher, 2012) and the Sexual Experiences Survey-Short Form Perpetration (Koss, Abbey, Campbell, Cook, Norris, Testa, Ullman, West, & White, 2006) to ascertain participants' beliefs and experiences. Participants are men aged 18-24 years in the D.C. area who complete the two instruments online. Then, data will be analyzed using a t-tailed hypothesis test at the 95% confidence level to determine if participants who associated women with objects were more likely to have perpetrated acts of unwanted sexual contact. Exploring how latent objectification affects consent, the study's findings will be presented along with its implications. The findings may help leaders who are working to prevent sexual assault design more informed prevention and interventions efforts with a net effect of reducing the level of unwanted sexual contact and increasing the recognition of women as fellow human beings.

---

#### PRIMARY PRESENTER

Teresa Cal

---

#### STATUS

Student – Undergraduate

---

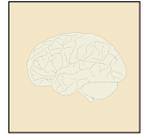
#### AUTHOR

Teresa Cal

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

Emily Morrison



---

## ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS

---

### Did French Economic Agents Accurately Describe the US Economy during the Great Recession? A Textual Analysis of Banque de France and Newspaper Publications, 2008-2010

The Great Recession again showed that the world's economies are interrelated, and thus economic agents must understand what is happening in other countries. This paper explores whether the French central bank and other French agents understood what was happening in the US economy during the Great Recession. It is hard to answer this question, though, due to a lack of public Banque de France quantitative forecasts of the US economy during this period. To respond to this query, qualitative publications from the Banque de France, such as annual reports and speeches, regarding the US economy were transformed into quantitative data, which were then compared to actual historical US GDP growth data. This process determined that central bankers from the Banque de France did understand the conditions of the US economy during the recession, and accurately conveyed it in qualitative publications. To determine whether the greater French population shared this accurate understanding, the same method was applied to Challenges, a French newspaper similar to the Wall Street Journal. This element of the study furthers the first method in two ways. First, by analyzing weekly newspaper publications, it was possible to obtain an analysis closer to real time than central bank annual reports can offer. Second, it analyzes information digested by a different type of audience than those who read central bank publications. The results here indicated that while Challenges' descriptions of the US economy during the recession did follow the general trend of US economic activity, its descriptions were more exaggerated than those of the central bank. This research contributes to the field in three ways. First, it successfully employs the relatively new and rarely used method of textual analysis to transform qualitative statements into quantitative data. Second, it brings similar studies into the international realm. Finally, it extends the methodology used in previous studies, given such an extraordinary recessionary situation. This methodology is a useful tool for individuals—even non-economists—to use to understand the conditions of an economy, domestic or international, in real time, especially where quantitative forecasts are unavailable.

---

#### PRIMARY PRESENTER

---

Emma Catalfamo

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHOR

---

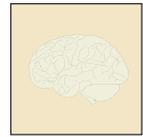
Emma Catalfamo

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Herman Stekler



---

## SCHOOL OF MEDIA & PUBLIC AFFAIRS

---

### Judicial Selection on Trial: An Analysis of the Boons and Banes of Various Statewide Judicial Selection Methods

The selection process for determining who represents the American people in their statewide legislatures and executive mansions is relatively standardized. Though ballots can differ between states, save for a few areas that embrace ranked choice voting, the person with a plurality of the votes is generally chosen for the office. However, no such standardization exists when it comes to selection methods for statewide judiciaries. Indeed, four methods of selection, competitive election, executive appointment, merit selection, and legislative appointment, are in use in different states today. What is more, there is no clear scholarly consensus as to which method performs best. The aim of this research project is to conduct, through regression analysis and other means, an empirical analysis that helps determine which method of selection is “ideal” given the criteria established through a thorough review of currently available literature. By compiling two data-sets, one dealing with the judges themselves, and one dealing with statewide rankings (e.g. Montana’s courts are more professional than Oklahoma’s), and by then analyzing this data-set, the project ads important empirical data to a field that, to this point, has been characterized more by qualitative research than quantitative. In the pilot study, which examined eight total states (two from each category of selection), there were some significant findings. When comparing selection methods to “professionalism”, a variable taken from *Squires’ Courtroom Professionalism Index* that includes factors such as (1) how closely judicial selection procedures followed the ABA selection model, (2) how closely state court organization approximated the ABA court organization model, (3) the presence of a professional court administrator and the size of the staff attached to that position, (4) how closely office tenures for major court and appellate court judges followed ABA guidelines, and (5) judicial salaries, it was found that the election of judges is significantly correlated with better courtroom professionalism, while merit selection is correlated with lower professionalism overall. Other factors did not deliver significant results in the pilot study, however, when the sample is expanded to include the total population of US states and statewide judges, it is possible that significance related to judge diversity, education, and income, as well as state rates of dissenting opinions and overturned rulings, will be observable.

---

#### PRIMARY PRESENTER

---

William Christian

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHOR

---

William Christian

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

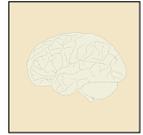
---

Kimberly Gross

---

# SOCIAL SCIENCES

---



---

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

## Can Women Have It All? An Experiment on the Challenges of Running for Office with Young Children

When former Congresswoman Pat Schroeder was asked how she could be both a mom to two young children and in the House of Representatives she replied, “I have a brain and a uterus and I use both.” Today, however, women with young children are still underrepresented in Congress and state legislatures across the country. While there have been widespread efforts to recruit women, many delay running for public office because they worry about how their families will be affected. Of the 113th Congress’s 83 freshman members (64 male, 19 female), 32 men but only 1 woman had children under age 18 (Rutgers CAWP). The fact that half of the new male members but only one female member came to Congress while their children were still at home raises questions about the role traditional gender socialization still plays in politics. Are women starting their political careers later by choice, or are voters holding them to a double standard? It is also possible that women with young children hold off running for office because they fear voters do not believe they are as capable of holding office while also raising children. While the literature has found decreasing evidence of gender stereotyping, there has never been a study that explicitly looks at voter perceptions of politicians with young children. This paper explores the results of my experiment, which evaluated whether voters view male and female candidates with young children differently when party is not a factor.

---

**PRIMARY PRESENTER**

---

Danielle Cohen

---

**STATUS**

---

Student – Undergraduate

---

**AUTHOR**

---

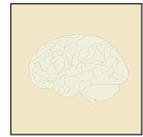
Danielle Cohen

---

**RESEARCH MENTOR/  
DEPARTMENT CHAIR**

---

Kimberly Gross



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Green Infrastructure Implementation for Stormwater Management through the Lens of Lessons Learned: Cleveland, OH, and Milwaukee, WI

The study of stormwater management has become increasingly important over the last decade due to rainwater run-off's continued negative impact on water quality and rising concerns about flooding in the light of climate change. Traditional strategies utilizing exclusively gray infrastructure implementations, such as sewer pipes and large-scale detention basins, have been deemed insufficient in providing an efficient and holistic stormwater management. In contrast, green infrastructure (GI) implementations, employing a variety of decentralized natural and engineered installations, has come to the fore as a more sustainable strategy.

While individual GI projects and programs have shown promising results, and lessons drawn from past-executed GI implementations aim to guide stakeholders' decision-making around the world, drainage-focused strategies in urban planning are still lacking a holistic analysis. As a novel approach, this research examines and extends Nickel, et al's (2013) lesson learned from Germany and uses these as a lens to analyze their applicability to the cities of Cleveland, OH, and Milwaukee, WI, chosen due to similar conditions of financial austerity, water quality, and quantity issues, and the challenge to reinvent themselves owing to economic shifts.

Semi-structured, open-ended interviews with key stakeholders in the two selected cities are iteratively analyzed through a set of critical coding tags. During the descriptive coding phase, responses are first organized by the individual lessons to validate their applicability, and secondly broken down into five separate focus areas, 1. administrative, 2. economic, 3. regulatory, 4. operational and 5. attitudinal. Using analytical coding processes, a variety of barriers to and strategies of GI implementations in these two U.S. cities are ascertained and juxtaposed in a matrix via which common response themes, differences, and gaps are identified.

First findings suggest that lessons learned from Germany find applicability in these two U.S. cities, allowing for an identification of key response patterns common to both cities. For instance, interviewees' coding-based response patterns suggest community involvement and public outreach being two commonly occurring topics of both interest and concern towards an improved adoption of GI practices amongst residents, and for the establishment of public support fostering local and regional GI efforts. In addition to common response themes, this analysis establishes strategies, barriers, and gaps unique to each location providing insights into the different developmental stages of urban GI implementation. These results may facilitate an improved resource allocation and planning effort towards a holistic and effective water management.

---

#### PRIMARY PRESENTER

---

Marietta Gelfort

---

#### STATUS

---

Student – Graduate

---

#### AUTHORS

---

Marietta Gelfort

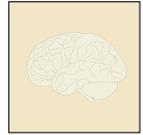
Melissa Keeley

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Melissa Keeley



---

## SCHOOL OF MEDIA & PUBLIC AFFAIRS

---

### Beyond the Crux of Crisis: A Look at Civil Liberties and National Security Rhetoric in Post-9/11 Antiterrorism Legislation

A sense of security left this country in the thick billowing black smoke that covered the Manhattan skyline on September 11, 2001. Any remaining veil of naively constructed protection collapsed with the twin towers, and the dark threat from terror cells glared back at the American people. American leaders failed to keep us safe.

The attacks on September 11 resulted in increased anxiety and concern for national security, and thus a sharp rise in support for anti-terrorism measures within the public and the government. The Uniting and Strengthening America by Providing Appropriate Tools Required to Intercept and Obstruct Terrorism Act, 2001 (USA Patriot Act) was signed by President Bush on October 26.

In the immediate crisis context of 9/11, news coverage illustrated that political discourse surrounding the USA Patriot Act was dominated by themes of national security, with minimal attention to civil liberty concerns. As the initial shock of the crisis began to fade, critics of the legislation became more vocal. The Bush administration continued to defend the USA Patriot Act, but over time activists and Congressmen began to more publicly voice concern for the freedoms and privacy compromised by the law.

While scholars have conducted studies examining the ways in which the Bush administration manipulated public discourse initially following the 9/11 attacks, there have been no long term studies analyzing how civil liberty frames were represented in the debate about the antiterrorism legislation each time a part of the law was up for renewal.

My study will look at the media's reflection of political discourse surrounding the passage of the first USA Patriot Act in 2001, the renewal of the USA Patriot Act in 2006, the extensions of the USA Patriot Act in 2010 and 2011, and the USA Freedom Act in 2015 to see (1) if discourse surrounding the respective legislation reflected a growing concern for civil liberties over time and (2) as the trauma of 9/11 began to fade, and the president no longer held a monopoly on national security discussions, who were the sources that promoted civil liberty frames? (3) Was there diversity in the presentation of frames? (e.g. valence and theme).

To analyze the discourse surrounding the legislation, I will conduct a content analysis of quotes in news coverage in the months before each iteration of the legislation was signed by the president. My research design includes coding the frames, themes, valence, placement, and sources of quotes from *The New York Times*, *The Washington Post*, *USA Today*, as well as the evening news from NBC, CNN and Fox. The results of my study will reveal what the framing looked like surrounding the passage of these bills and who was driving the political rhetoric.

---

#### PRIMARY PRESENTER

---

Danielle Gillon

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHOR

---

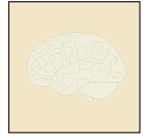
Danielle Gillon

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Kimberly Gross



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Examining States' Temporary Assistance for Needy Families Expenditures

The Personal Responsibility and Work Opportunity Reconciliation Act of 1996 reshaped United States' welfare policy. The replacement of Aid for Families with Dependent Children with Temporary Assistance for Needy Families (TANF) revoked qualifying families' legal guarantee of cash assistance benefits and instituted a state-administered block grant program. Reflecting contemporary concerns over rising cash assistance caseloads and centralized government, TANF gives each state an annual block grant and the authority to allocate the funds in any way "reasonably calculated" to realize its statutory goals. States utilize this flexibility to fund a wide variety of programs in addition to cash assistance for needy families, including work supports, childcare assistance, pregnancy prevention initiatives, and refundable tax credits.

Although consequential, little progress has been made in answering how states' allocations of their TANF block grants have changed over time and what political, economic, and social factors correlate with states' TANF expenditures. My research aims to further scholarship concerning both questions. Drawing on data published by the Administration for Children and Families, I created a database of every state's TANF expenditures in ten funding categories between fiscal years 1998 and 2013. To overcome significant methodological challenges in the data, I used funding categories developed by the Center on Budget and Policy Priorities and calculated three-year moving averages of the expenditures. Drawing on this database, I undertake a descriptive analysis of states' TANF spending. My findings indicate that over time, states shifted their expenditures away from cash assistance toward other sources, including pregnancy prevention initiatives and refundable tax credits. The reductions in cash assistance expenditures were dramatic: The median state spent 22% of its total TANF funds on cash assistance in fiscal year 2013, a decrease of 30% from fiscal year 1998.

My descriptive study is the foundation for an analysis of what state-level factors, such as change in cash assistance caseload, partisan control of government, proportion of African Americans in the population, and proportion of Hispanics in the population correlate with states' TANF expenditures. Preliminary findings indicate that states diverted expenditures away from cash assistance as cash assistance caseloads decreased, implying a rational basis for reallocation. However, results also suggest strong and significant negative relationships between the proportions of African Americans and Hispanics in a state and cash assistance spending. If corroborated by further analysis, these findings would fit within broader themes in the welfare literature concerning the significance of race and ethnicity in United States' social policy.

---

#### PRIMARY PRESENTER

---

Ben Goehring

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHOR

---

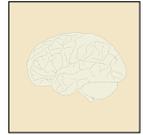
Ben Goehring

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Robert Stoker



---

**SCHOOL OF MEDIA & PUBLIC AFFAIRS**

---

## Racial Appeals in Candidate Twitter Communication in the 2016 U.S. House Elections

This study examines the racialized content of House candidates' messaging on Twitter in the 2016 election. Racial attitudes were a prominent electoral factor in 2016, following the Presidency of Barack Obama, whose candidacy and status as the nation's first Black president made race a "chronically accessible" consideration for the American public. Negative racial, ethnic, and religious sentiments remained salient amidst the candidacy of Donald Trump, whose explicit appeals and implicit coded language allowed him to garner a high degree of support from the racially resentful. This research investigates how House candidates acted in this racialized context by studying their Tweets. Twitter is a medium that allows candidates to speak directly with their supporters, providing potentially fertile ground for racialized messages and other appeals to negative ethnic and religious out-group sentiment. In particular, this analysis distinguishes between candidates' racially liberal appeals to in-group belonging and authenticity, and racially conservative appeals to stereotypes and negative predispositions. It furthermore distinguishes between explicit appeals, code words, and other racialized policy references. The research considers candidates along a range of demographic categories, investigating what qualities, in 2016, prompted House candidates to take advantage of the racialized atmosphere through appeals that could activate racial predispositions.

---

**PRIMARY PRESENTER**

---

Emma Grundhauser

---

**STATUS**

---

Student – Undergraduate

---

**AUTHOR**

---

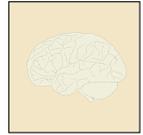
Emma Grundhauser

---

**RESEARCH MENTOR/  
DEPARTMENT CHAIR**

---

Kimberly Gross



---

**ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS**

---

## How do Women’s Human Capital Endowments Determine their Labor Force Participation in the Philippines’ Labor Market? A Case Study from 2006-2015

This paper tests the relationship of human capital endowments of Filipina women and their rate of labor force participation in the Philippines domestic labor market using fourth quarter data from the Philippines’ Labor Force Survey (2006-2015). I combine this econometric approach with participant observation and interviews that I completed in Manila, the capital of the Philippines, in the summer of 2016 and Singapore in January 2017. Preliminary regression analysis suggests a positive relationship between increasing economic growth rates and labor force participation of women, which corroborates the testimonies of my interview respondents. This research adds to the understanding of domestic labor force workers in the Philippines, as much contemporary research on the Philippines focuses on overseas workers and remittances.

---

**PRIMARY PRESENTER**

---

Hannah Hassani

---

**STATUS**

---

Student – Undergraduate

---

**AUTHOR**

---

Hannah Hassani

---

**RESEARCH MENTOR/  
DEPARTMENT CHAIR**

---

Elizabeth Chacko



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Investigating Gender-Inclusive Hate Crime Statutes

This paper is an exploration into the variation of how different states in the United States legislate and prosecute anti-female hate crimes to determine whether hate crime legislation is an effective response to violence against women, especially sexual assault. The first step of investigating the effectiveness of hate crime legislation is to examine the literature, like Gelber and Chen, that explores how violence against women, especially sexual violence, can and should be covered under hate crime law. In order for violence against women to be included as a hate crime, gender must be considered a protected class. Despite gender being included on the federal level since 1993, only twenty-four states and DC statutes include the term “gender” or “sex.” I explore the literature on policy diffusion, where there is very little on hate crimes and even less on gender. However, using Soule and Earl and Makse and Volden works, I can see if their theories on hate crime policy diffusion applies to whether states adopt gender-inclusive statutes.

There is significant variation in how even these twenty-four states write their laws, some are lengthy and specific while others are brief and vague. I investigate if the variation in the state statutes creates different outcomes. My data is state level statutes and their annual crime reports, and the variations in data can be presented in charts and maps. My findings were that the amount of anti-female hate crimes reported in each state is usually less than five per year, regardless of the state’s population or the detailed language of the statute. A potential explanation for the low reporting is found in McPhail and DiNitto’s interviews showing that prosecutors are often not aware of the law allowing for sexual violence against women to be classified as a hate crime, and that even when they are aware of it, they often don’t agree with it.

In conclusion, I will discuss the policy implications. If gender-based hate crime statutes are not efficient in addressing violence against women, activist communities must decide how many resources to put into enacting this. However, gender-inclusive language in hate crime statutes can have further policy inclinations, such as more effectively protecting trans individuals. This adds to current literature by bringing the discussion from can sexual violence be classified as a hate crime, to what happens if we legally do.

---

#### PRIMARY PRESENTER

---

Jocelyn Jacoby

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHOR

---

Jocelyn Jacoby

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Cynthia Deitch

---

# SOCIAL SCIENCES

---



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Consumer-Based Prosocial Behavior: Mood, Manipulative-Intent and Donations

Guilt appeals have become commonplace within charitable organizations. In fact, individuals may in some cases feel guilty about purchasing luxury products if they detect discrepancies between their own well-being and that of others and, as a result, increase their donation intentions.

On the other hand, when charitable organizations over-use appeals through advertisements, donation intentions tend to decrease, because the advertisement may be perceived as manipulative (Lwin & Phau, 2014). As many retailers also choose to cooperate with charitable organizations to promote products and facilitate brands, it is important to investigate the effectiveness of this (donation-focused) marketing strategy.

The proposed research examines how consumers, retailers and prosocial behavior can all drive changes in individual mood, perceived manipulative intent, and donation intentions. It is hypothesized that participants who spend money on luxury items, rather than non-luxury or discounted goods, are more likely to feel guilty, perceive retailers as more manipulative and donate less money. Participants with high (baseline) levels of (a priori) prosocial behavior are expected to experience higher levels of guilt, perceive retailers as less manipulative and donate more money. Additionally, retailers using assertive (versus passive) prompts for donation promotion are expected to be perceived as more manipulative, and participants will likely feel more guilty but donate less money. The results of this study can ultimately help researchers, retailers, and charitable organizations to better understand the highly dynamic world of charitable behavior.

---

#### PRIMARY PRESENTER

---

Zhuo Jin

---

#### STATUS

---

Student – Graduate

---

#### CO-PRESENTERS

---

Nils Olsen

Natalie Flacco

Tianshan Fullop

---

#### AUTHORS

---

Zhuo Jin

Nils Olsen

Natalie Flacco

Tianshan Fullop

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Nils Olsen



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Assessing Edge Damage in MSA Lithic Assemblages: Experimental Proxies for the Analysis of Use and Post-Depositional Damage

Given the low frequency of retouched stone tools in many African Middle Stone Age (MSA) assemblages, the analysis of edge damage on simple unretouched artifacts offers a promising depth of insight into tool-use behavior. Taphonomic process such as trampling, however, can also cause edge damage on lithic artifacts. As part of the investigation of GaJ17, an MSA site in the Koobi Fora region (Kenya), we conducted an experiment designed to investigate differences between edge damage resulting from use and that resulting from post-depositional damage. Damage was inflicted on the edges of a series of ignimbrite flakes in a variety of experimental contexts (e.g. butchery, trampling). These experiments mimicked processes that may inflict damage on tool edges. We assessed the relationship between edge angle and the intensity and continuity of edge damage in these experimentally damaged artifacts. A qualitative assessment of the intensity and continuity of edge damage was used to distinguish use from post-depositional damage. These criteria were applied to *in situ* and surface collections from GaJ17. These analyses sought to test whether the archaeological assemblages exhibit patterns of damage more similar to experimental use or trampling.

---

#### PRIMARY PRESENTER

---

Courtney Jirsa

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHORS

---

Courtney Jirsa

Tamara Dogandžić

Kathryn L. Ranhorn

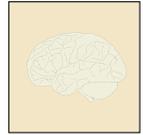
David R. Braun

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

David R. Braun



---

**COLUMBIAN COLLEGE OF ARTS AND SCIENCES**

---

## Limitations to Post-Secondary Education Among Marginalized Youth in Arequipa, Peru

Since the mid-1900s, Peru has experienced a drastic increase in internal migration from the Andean rural highlands to metropolitan areas. Migrants typically resettle on the outskirts of major cities in search of greater opportunities and better access to amenities. These dynamic migrant communities, such as the Annex of Machaguaya located in the Mollebaya district of Arequipa, are known as pueblos juvenes (young towns) and are home to many youths who aspire to obtain a post-secondary education. However, as they work to reach their goals, many are forced to lower their academic ambitions. What individual and structural level factors can help explain these outcome disparities? The present study addresses these questions by drawing on semi-structured qualitative interviews with eleven students and ten parents living in the Annex of Machaguaya. Of the eleven students, all of whom had graduated high school in the past four years, eight currently attend a post-secondary institution. Overall, parents and students expressed high aspirations for post-secondary education and recognized its importance in achieving upward social mobility and a better quality of life. Findings suggest various socioeconomic, familial, and structural factors limit students' access to higher education and lead to a discontinuity between the students' aspirations and their current academic trajectories. Among these factors, the economic situation of one's family is the most consistent and critical obstacle encountered. Lower socioeconomic status constrains students' institutional options for post-secondary education and decreases their opportunities to prepare for the entrance exams. Parents and students also noted inadequate information regarding careers, institutions, and entrance exams as the students prepared for life after high school, which decreased their ability to make informed decisions. Limited access to information appeared to be associated with the youths' status as first-generation college students as well as the spatial marginalization of their places of residence and primary schools relative to the city-center. These findings support conclusions from previous studies suggesting that socioeconomic status and inadequate information regarding higher education act as the main factors affecting students' access to higher education. Although educational attainment is often viewed as a means of breaking barriers between economic classes, the present study also suggests students from different class background compete for access to fundamentally different types of post-secondary institutions, which may reproduce structural inequality. Collectively, these findings raise questions about why these barriers continue to persist and what is being done to increase equal access to post-secondary education in Peru.

---

**PRIMARY PRESENTER**

---

Rachel Kahn

---

**STATUS**

---

Student – Undergraduate

---

**AUTHOR**

---

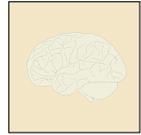
Rachel Kahn

---

**RESEARCH MENTOR/  
DEPARTMENT CHAIR**

---

Daniel Martinez



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Analyzing Associations Between Seniors' Self-Perception of Community Quality and Self-Perceptions of Wellness

Considerable research confirms that community characteristics are linked with wellness. Wellness is defined by the President's Council on Fitness as a "multidimensional state of being, describing the existence of positive health in an individual as exemplified by quality of life and a sense of wellbeing" (Corbin & Pangrazi, 2001, p. 1). Research supports a link between community and some aspects of wellness, as suggested by the finding that communities with lower incomes have higher incidence rates of self-reported "poor health" than affluent communities (Ellaway et. al, 2012). This indicates that the neighborhood environment can pose challenges to physical health, one aspect of wellness. This relationship between community and one's wellness highlights the importance of research on how communities support or challenge an individual's wellness.

This knowledge of community's impact on wellness magnifies when paired with an important demographic shift: the dramatic increase in the senior population projected to occur through 2050 (Ortman, Velkoff & Hogan, 2012). As "Baby Boomers" age, the population of older individuals in the United States will be approximately 83.7 million, over double the population in 2012 (Ortman, Velkoff & Hogan, 2012). The available literature on senior well being states that seniors exhibit better health when they maintain social bonds within their community (Norstrand & Chan, 2014). However, wellness is a multifaceted concept, including aspects such as social, physical, and intellectual wellness; our study utilizes a multidimensional approach to wellness, which provides a more comprehensive look into the factors of senior wellness when compared to past research that has used a narrow conception of wellness or its components.

The primary aim of this study was to examine how perceptions of the neighborhood context are associated with senior's wellness. Using a student-implemented interview, undergraduate students conducted 115 interviews over 2 semesters with seniors aged 60 to 94 years (mean=74.06) residing in Washington D.C. The majority (77%) of the participants were female. Participants responded to questions about community cohesion and disorder (Cagney, 2009) and rated their perception of wellbeing based on an adapted dimensional wellbeing model proposed by Gallup. Six dimensions of wellbeing were assessed: physical, intellectual, community, financial, spiritual, and social wellness. Results showed that social cohesion was significantly positively associated with better physical, intellectual, social, and community wellbeing. These findings suggest that interventions and policies focused on senior isolation and social development may contribute to improving senior wellness.

---

#### PRIMARY PRESENTER

---

Tyler Kane

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHORS

---

Tyler Kane

Sharon Lambert

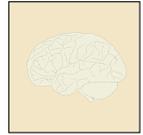
Emily Morrison

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Sharon Lambert



---

## COLLEGE OF PROFESSIONAL STUDIES

---

### Stereotypes of Saudi Women in USA

The coverage of Saudi Arabia by U.S. media often includes negative terms such as “terrorist”, “terror attacks” and “Islamic extremism” and suggests a conflictive posture that is detestable in the eyes of the American public. Such a reputation has been further imposed on public perception concerning the image of Saudi females in the Washington, D.C. This paper will present strategies that the Embassy of Saudi Arabia should use to help restore a positive image of Saudi women despite a series of crises that have contributed to negative stereotypes over the past decade. These strategies will be illustrated by analysis of marketing plans, media policy, public relations techniques and the components of publicity campaigns,

This study will discuss this issue from both theoretical and practical viewpoints. Theory used to guide the research and to interpret the data gathered from students, professors, and alumni from The George Washington University, while the empirical analysis will apply theories to practice by developing an image-building communication plan for the Royal Saudi Embassy in Washington D.C., and starting the communication activities at GW’s Foggy Bottom campus.

---

#### PRIMARY PRESENTER

---

Wedyan Kattan

---

#### STATUS

---

Student – Graduate

---

#### AUTHOR

---

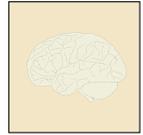
Wedyan Kattan

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Larry Parnell



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Self-Efficacy, Response-Efficacy, and Sex

In trying to better understand and prevent sexual violence on college campuses, researchers have examined individual characteristics that may affect a person's willingness to intervene as a bystander in situations of sexual assault or those potentially leading to sexual assault. Two beliefs that may play a role are "response-efficacy" and "self-efficacy." Self-efficacy refers to the person's belief that he or she can complete behaviors, both generally and within domains, in this case, the ability to intervene (Bandura, 2006). Response-efficacy is a person's belief that a recommended action will lead to the desired outcome, in this case, will prevent sexual assault (Rogers, 1983). Higher levels of self-efficacy and response-efficacy have been associated with greater willingness to intervene as a bystander in situations involving sexual assault (Banyard, Moynihan, & Plante, 2007; Floyd, Prentice-Dunn, Rogers, 2000). Previous studies have found that men report less likelihood of intervening in situations involving sexual assault, (Exner & Cummings 2011; Senn, & Forrest, 2016; Voller et al, 2015). One possible explanation for this gender difference could be differing levels of self-efficacy and response-efficacy between men and women.

In the current study, self-efficacy and response-efficacy beliefs about bystander intervention to prevent sexual assault were examined. It was hypothesized that (1) men would report lower feelings of self-efficacy regarding bystander intervention than women, and (2) men would report less response-efficacy regarding bystander intervention compared to women. A sample of undergraduates ( $n=350$ ) were surveyed on their levels of response-efficacy and self-efficacy regarding bystander intervention. An ANOVA F-test was conducted to measure the difference in levels of efficacy by sex.

Women were higher than men on levels of self-efficacy ( $F=7.63, p<.01$ ). There was no significant difference between men and women on response-efficacy.

This suggests that while men and women have similar levels of belief in the effectiveness of actions such as bystander interventions to prevent sexual assault, women are significantly more confident than men in their ability to engage in those actions. This finding has implications for sexual assault prevention on college campuses; for example, perhaps men may benefit more from additional practice in bystander role-plays to increase their confidence in their ability to act to prevent sexual assault. Future studies should investigate how to boost the confidence of all community members in order to prevent sexual assault.

---

#### PRIMARY PRESENTER

---

Emily Lauster

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHORS

---

Emily Lauster

Jared Axelowitz

Catherine Coogan

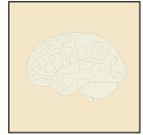
Cynthia Rohrbeck

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Cynthia Rohrbeck



---

**COLUMBIAN COLLEGE OF ARTS AND SCIENCES**

---

## Bias in the Classroom: Understanding How Obesity Bias Affects Teacher Interactions with Students

Bias in education can favor or disfavor certain students or groups of students and there is growing awareness of weight bias in classrooms. In the United States, obesity is on the rise due to individuals living an increasingly sedentary lifestyle and overconsuming highly caloric foods (Balog, 2015). It was estimated that 43 million children were either overweight or obese in 2010 (Wang & Lim, 2012). Research has shown that children struggling with their weight tend to have more social problems, whether it be bullying or self-esteem issues, than their average weight peers (Kornilaki, 2014). This is especially pertinent among elementary school students in 4th and 5th grade. Teachers, formally and informally, may be able to play a role in mitigating or exacerbating these feelings of victimization among children who are overweight or obese. Existing literature has examined the bias of physical education teachers in regards to weight, but little is known about teachers in traditional classrooms. The purpose of this study is to understand how weight bias can affect student-teacher interactions. The study consists of an Implicit Association Test (IAT) and qualitative interviews with in-service educators teaching 4th and 5th grade students in the District of Columbia. The IAT provides initial insights into how teachers feel about weight. Following the IAT, participants complete a qualitative interview where they are able to discuss the results of the IAT, making sense of their bias (whether it be positive or negative), identifying how it may affect classroom interactions and exploring ways to address bias in the classroom. The findings may help inform teacher education practices and professional development trainings for in-service elementary school teachers.

---

**PRIMARY PRESENTER**

---

Rebecca Levy

---

**STATUS**

---

Student – Undergraduate

---

**AUTHOR**

---

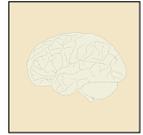
Rebecca Levy

---

**RESEARCH MENTOR/  
DEPARTMENT CHAIR**

---

Emily Morrison



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Images of Genocide: How American College Students' Perceptions are Affected by Images Chosen to Represent Genocide

The purpose of this research study is to explore the potential effects of imaging on college students' perception of genocide using the theory of psychic numbing, which describes how sensitive images can become desensitizing, as a lens through which the data will be analyzed. Understanding study participants' experiences are imperative because images and public perception have the ability to capture attention and create an impression that can alter one's original thoughts or opinions. The alteration of thoughts and opinions is especially true in regards to international affairs stories, specifically genocide, because people rely on images to fully understand the gravitas of a situation that they are unable to experience directly. The literature surrounding this topic is heavily focused on advertisements and does not measure the desensitization surrounding images when paired with international organizations' persuasive appeals. The following experiment uses three different images of the South Sudan genocide: one image with only statistics, one image of a single victim of genocide, and one image with multiple victims of genocide. These images are randomly presented in different sequences to the participants in order to see if the order of the images changes how people respond. Findings and implications will be presented.

---

#### PRIMARY PRESENTER

Abbie Martin

---

#### STATUS

Student – Undergraduate

---

#### AUTHOR

Abbie Martin

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

Emily Morrison



---

**CORCORAN SCHOOL OF THE ARTS & DESIGN**

---

## A New Method to Quantify Indicators of Stress in Great Ape Canines

Linear enamel hypoplasia (LEH) is a condition marked by localized reductions in enamel thickness, usually in the form of horizontal bands around the tooth crown. Each defect reflects a temporary interruption to enamel growth, and is understood to represent an episode of physiological stress. LEH has been associated with malnutrition and disease in humans, yet its etiology in wild primates remains unknown. Previous work suggests that LEH is ubiquitous among humans and great apes, with ~90% of individuals exhibiting at least one defect. Mountain gorillas were the exception, with defects found in only 11% of individuals. Two main hypotheses were proposed to explain their low frequency: 1) mountain gorillas are buffered from seasonal lows in fruit availability as dedicated folivores, and/or 2) due to their rapid enamel growth, mountain gorilla defects are shallower than in other apes, and are therefore more difficult to detect using traditional qualitative techniques. Here, mandibular canine replicas from each of four great ape taxa (*Gorilla beringei beringei*, *G. gorilla gorilla*, *Pan troglodytes*, and *Pongo sp.*) were scanned using a Sensofar Plu Neox confocal profiler at the University of Tübingen, Germany. High-resolution digital elevation models ( $n=255$ ) were analyzed using a new quantitative method. Defects were qualitatively targeted for scanning, and their diagnosis was confirmed using the FindPeaks plugin in ImageJ software. Defect depths range from 6-276 microns, with a mean of 42 microns, well outside the observed range of perikymata depth ( $>1-3$  microns), which are growth increments representing normal development. Using a linear mixed model, mountain gorillas were found to exhibit significantly shallower defects than all other taxa ( $p<0.0001$ ), which may have led researchers to underestimate their LEH prevalence when scoring teeth qualitatively. Females have significantly deeper defects than males in all taxa ( $p=0.016$ ). Next steps include evaluating the influence of underlying microanatomical differences on defect morphology among these taxa, and to test correspondence with major life events (e.g. intergroup encounters, illness, or injury) by referencing associated life history records in wild mountain gorillas.

---

**PRIMARY PRESENTER**

---

Kate McGrath

---

**STATUS**

---

Student – Graduate

---

**AUTHORS**

---

Kate McGrath

Sireen El Zaatari

Mike R. Cranfield

Tara S. Stoinski

Antoine Mudakikwa

Timothy G. Bromage

Shannon C. McFarlin

---

**RESEARCH MENTOR/  
DEPARTMENT CHAIR**

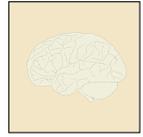
---

Shannon C. McFarlin

---

# SOCIAL SCIENCES

---



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Preventive Conservation: Preserving the Past

As part of a research project carried out to understand how preventive conservation and qualitative risk assessment measures can be applied to museum collections, a team of four Museum Studies graduate students—Ellie Gibson, Katie McKendry, Sam Olsen, and Dana Willan—monitored the current environmental conditions in the *First Ladies* exhibition at the National Museum of American History for nine weeks from September 25, 2016 until November 23, 2016. We took measurements of temperature, relative humidity, and light intensity in three locations within the exhibition. Additionally, we analyzed eight specific objects currently on display to better understand the integrity of the objects and their response to certain environmental conditions as well as to learn how to best preserve the objects for the long-term, by employing preventive conservation techniques.

Dresses, accessories, and objects belonging to several First Ladies of the United States have been on display at the Smithsonian Institution since 1914. The dresses were initially part of the *Collection of Period Costumes* exhibition at the Smithsonian’s Art and Industries Building. In 1955, the dresses received their own exhibition, entitled *First Ladies*, and in 1964 they were moved to the Museum of History and Technology (now the National Museum of American History). Objects analyzed in the research project included a sherry glass used by Mary Todd Lincoln, a porcelain sauceboat used by Louisa Catherine Adams, dresses worn by Michelle Obama, Caroline Harrison, and Frances Folsom Cleveland, a painted paper fan used by Dolley Madison, and a copy of the book, *Treasure Island*, given as a gift by Edith Roosevelt and inscribed to a family friend.

Several risks noted in the collection included high radiation levels in one area of the exhibit, which could cause long-term damage to the collection. Pest infestation, contaminants or pollutants from exhibit carpeting were also considered as potential risks. The gallery space should continue to maintain a proper environment due to the exhibit cases’ mitigation of the objects’ exposure to most temperature and humidity fluctuations. We recommended additional light and temperature monitoring to determine whether certain lights should be dimmed, and whether certain cases need to be cooled. Further, we recommended that certain objects be rotated off display at some point in the future to avoid cumulative light damage. Set-points for temperature and humidity in this space should be lowered, and future upgrades to the HVAC system should be considered if the current system is inadequate.

---

#### PRIMARY PRESENTER

---

Katie McKendry

---

#### STATUS

---

Student – Graduate

---

#### CO-PRESENTER

---

Ellie Gibson

---

#### AUTHORS

---

Katie McKendry

Ellie Gibson

Samantha Olsen

Dana Willan

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

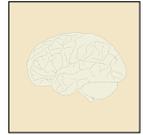
---

Shelley Sturman

---

# SOCIAL SCIENCES

---



---

## GRADUATE SCHOOL OF EDUCATION AND HUMAN DEVELOPMENT

---

### Connected: A Study of Authentic Leaders and their Social Media Presence

Authentic leaders increase their legitimacy by continuously portraying their true self. These leaders aim to create meaningful relationships with their followers based on trust (Walumbwa, Avolio, Gardner, Wernsing, Peterson, 2008). Followers identify with authentic leaders because they are able to connect with the leader's genuine characteristics and real self. In today's technologically driven society, leaders have the ability to interact with a mass group of individuals through social media. However, there is little research to show if individuals are able to identify with authentic leaders on these platforms. The purpose of this research is to examine if authentic leaders can effectively communicate their authenticity via social media. A mixed methods research design was used to conduct the study.

The leaders used in the study were volunteer MBA students at the George Washington University. The volunteer MBA students were asked to take the Authentic Leadership Questionnaire (ALQ) (Avolio, Gardner, Walumbwa, 2007) to measure their level of authenticity. The participants were then asked to create a social media account for each of the following sites: Facebook, Instagram, LinkedIn, Snapchat, and Twitter, all of which contributes to their social media presence. The participants were then given various scenarios, and they were asked to respond to these scenarios on their social media accounts. At the end of the study their responses were recorded and a content analysis was done on each participants' social media presence to determine authenticity. These scores were compared to their self-reported ALQ score.

Subsequently, volunteer, undergrad students from the George Washington University were then given the various scenarios and asked to view three randomly assigned social media profiles. After each view, the undergrad student was asked to take the ALQ to assess the leader's authenticity. These scores were then compared to each leader's original ALQ score and their content analysis score. IRB approval will be sought prior to project start and data gathering. The goal of this research is to provide more knowledge about the scope of authentic leaders on social media.

---

#### PRIMARY PRESENTER

---

Brian Mojica

---

#### STATUS

---

Student – Graduate

---

#### AUTHOR

---

Brian Mojica

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Shaista E. Khilji

---

# SOCIAL SCIENCES

---



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Keeping Up With the Appropriation

In the past few years, the racial tensions and race relations have come to the forefront of the United State's political and cultural debates. While it may once have seemed our country is in a "post-racial" state, many people of color would argue that the racial issues in the country have merely become more covert. One of the best examples of the covert racism of today is cultural appropriation, which has been taking the Internet by storm recently. The practice of appropriating pieces of culture from communities of color in order to create trends and gain capital has many activists and communities up in arms. For my research project I intend to study the implications of cultural appropriation in American popular culture by using the Kardashian family as a case study. I will examine their several romantic and platonic relationships with black people in the context of their frequent, often televised, displays of ignorance about the culture, struggles and oppression of black peoples. Similarly, I will examine several pop-culture media outlets that describe the fashion, beauty and fitness trends of the Kardashians. These media reports often give them credit for creating "trends" that have existed within communities of color for extended periods of time. With this information I will then conduct interviews with young adults, and create a play based on their life experiences and my research combined.

This project strives to bring to light the ways in which cultural appropriation and pop culture affect the lives of young adults. With its unique approach of both traditional academic research combined with the integration of the personal experience of young adults, will bring a unique perspective and approach to this topic. With this project I hope to not only use theater as a means to bring light to the need for change, but to also incite it. I hope to highlight the ways in which cultural appropriation and racism are damaging to the livelihoods of people of color, but to also offer solutions, both of the everyday and grand-scheme variety. This piece will not just be a space for people of color to come and see their experiences represented; it will hopefully be a source of inspiration, a starting point, a significant piece of a cannon of works that use art as a way to create change in modern American society.

---

#### PRIMARY PRESENTER

---

Brianna Nobles

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHOR

---

Brianna Nobles

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Melani McAlister

---

# SOCIAL SCIENCES

---



---

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

## Market Manager Relationships Around Financial Incentive Programs at D.C. Farmers' Markets

Nationally, less than 1% of the money distributed as a part of the Supplemental Nutrition Assistance Program (SNAP or food stamps) is redeemed at community farmers' markets. Financial incentive programs such as matching dollars programs incentivize participants in food assistance programs, such as SNAP, to shop at markets both to economically support farmers and to increase healthy food access. Literature has often noted the success of these programs solely in terms of these two outcomes. However, little research has sought to show how financial incentive programs affect market spaces in terms of relationships. The purpose of this study is to explore market manager relationships with both farmers and customers at urban D.C. farmers' markets where local financial incentives (ie. the Produce Plus Program, and matching programs) are accepted. By exploring the voices of D.C. market managers as they connect to relationships and financial incentives, this work seeks to understand how community spaces that operate these programs look and feel. Utilizing both qualitative interviews and 5-Point Likert Scale questionnaires, the proposed study will reflect the lived experiences of D.C. market managers from over 6 market organizations city-wide. In addition to filling a gap in academic research around financial incentives at farmer's markets, this research will present the best practices of relationship and community building currently utilized in these spaces as voiced by participants in this study. These best practices will be compiled into a toolkit and distributed to farmers' market organizations across the city with the intent to encourage continued community building around financial incentive programs. Study findings will be presented and discussed.

---

**PRIMARY PRESENTER**

Sara Policastro

---

**STATUS**

Student – Undergraduate

---

**AUTHOR**

Sara Policastro

---

**RESEARCH MENTOR/  
DEPARTMENT CHAIR**

Emily Morrison



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Stigmatizing Effects of Perceived Responsibility for Causing and Resolving One's Eating Disorder

Individuals who have eating disorders or are obese experience stigmatization, which can lead to a variety of negative outcomes including further disordered eating and lower self-esteem (Puhl & Suh, 2015). Research on stigmatization of individuals with eating disorders and contributors to it is important to improve public understanding and enhance treatment effectiveness. In the present study, we examine perceptions of individuals with anorexia nervosa (AN) and binge eating disorder (BED) in relation to views of a client's responsibility for having an eating disorder and for overcoming it. This study expands upon previous research, in which responsibility for solving one's problem is understudied. The goals of the study are: (1) to compare stigmatizing perceptions of young women with BED and AN, and (2) drawing on Brickman et al. (1982), to explore the implications for stigmatization of information presented by a therapist about, and participants' perceptions of, the client's personal responsibility for causing and resolving her eating disorder. We hypothesized that high responsibility for causing the disorder would have more negative implications than high responsibility for resolving it.

Participants read a one-page vignette describing a female college student diagnosed with either AN or BED. One of five therapist assessments of the client was then presented: Low responsibility for cause/Low responsibility for solution, High responsibility for cause/low responsibility for solution, Low responsibility for cause/High responsibility for solution, High responsibility for cause/High responsibility for solution, and a Control/No further information condition. Scales measured perceived causality and responsibility, and multiple aspects of stigma.

The client with BED was viewed as more personally responsible for causing her condition than the woman with AN; however, the woman with AN was viewed as more impaired or maladjusted, confirming previous research. Responsibility for causing one's eating disorder was found to have a greater impact on stigmatization than responsibility for resolving the disorder. This was especially clear when participants' perceptions of responsibility rather than manipulated responsibility were analyzed. Although the results confirm previous research in some respects, they leave open questions about the influence of responsibility for solving one's disorder on stigmatization.

---

#### PRIMARY PRESENTER

---

Sabrina Porcelli

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHORS

---

Sabrina Porcelli

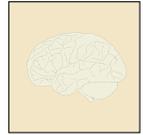
Carol Sigelman

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Carol Sigelman



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Subclinical Eating Disorder Traits are Correlated with Cortical Structure in Regions Associated with Food Perception and Food Reward

Although many studies have found atypical brain structure in clinically-diagnosed eating disorders, no studies to date have explored individual differences in brain structure as a function of subclinical eating disorder traits. Therefore, we seek to identify neural endophenotypes in large and relatively unconfounded subclinical samples. In the current study we correlate variation in cortical thickness with scores on two Eating Disorder Inventory-3 (EDI-3) subtests: Bulimia and Drive for Thinness. 456 young adults (313 female:143 male) self-reported drive for thinness traits, and 247 young adults (169 female:78 male) self-reported bulimia traits and provided one anatomic MRI scan. The CIVET brain-imaging pipeline (v2.0) and SurfStat were used to derive vertex-level cortical thickness values and complete analyses. There were significant negative correlations between drive for thinness traits and cortical thickness in the right insula, and between bulimia traits and cortical thickness in the bilateral insula, left posterior parietal, left somatosensory, and right orbitofrontal cortices (FWE-corrected  $p < .05$ ). Furthermore, in subjects showing higher EDI-3 traits, there was diminished correlation between these key regions and the rest of cortex (FWE-corrected  $p < .05$ ) compared to those with lower EDI-3 traits. Strikingly, self-ratings of EDI-3 traits were correlated with thickness in distinct cortical regions (e.g., insula and orbitofrontal cortex) that are crucial to food perception and food reward. Furthermore, higher levels of these traits negatively modulated anatomical coupling between these regions and other portions of cortex. These findings complement the clinical literature, and provide additional evidence that these neural signatures can serve as informative endophenotypes for future genetic studies.

---

#### PRIMARY PRESENTER

---

Emily Richard

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHORS

---

Emily Richard

Cynthia Peng

Esha Mehta

Caylynn Yao

Annchen Knodt

Ahmad Hariri

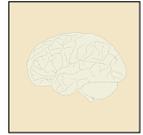
Gregory Wallace

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Gregory Wallace



---

## CORCORAN SCHOOL OF THE ARTS & DESIGN

---

### Knowing a Victim, Sex, and Rape Myth Acceptance

Rape myth acceptance was introduced by sociologists and feminist thinkers as a set of complex cultural beliefs that support and perpetuate sexual violence (Payne, Lonsway, & Fitzgerald, 1999). Rape myths are hypothesized to perpetuate sexual violence by blaming the victim of sexual assault and minimizing or justifying the violence of the perpetrator. Rape myth acceptance can have devastating real-world consequences, including increased likelihood of perpetrating sexual assault, and disbelief in the rates and impact of sexual assault (Grubb & Turner, 2012). Rape myth acceptance has been associated with less willingness to help in a situation of witnessing sexual violence (McMahon, 2010). Research has consistently demonstrated that men are likely to endorse greater RMA than women (see Grubb & Turner, 2012 for review). One important influence on rape myth acceptance may be knowing a victim of sexual assault. One study found that college students who had a friend who disclosed that they had been a victim of sexual assault were more likely to help a hypothetical rape victim and attributed less blame to the rape victim than those who had not received a disclosure (Paul, Kehn, Gray, & Salapska-Gelleri, 2014). Therefore, knowing a victim of sexual assault may be an important tempering influence on rape myth acceptance.

In the current study, a sample of undergraduates ( $n=350$ ) were asked about their rape myth belief and if they knew a victim of sexual assault. We hypothesized that similar to previous research, men would score higher on RMA than women. We also predicted that those who knew victims of sexual assault would score lower on RMA. Finally, we predicted that in the case where men had received a disclosure of sexual assault, their scores on RMA would be lower.

An ANOVA F-test found that women endorsed lower RMA than men ( $F=5.10$ ;  $p<.05$ ). Individuals who knew victims of sexual assault also endorsed lower RMA than those who did not ( $F=5.84$ ,  $p<.05$ ). Finally, there was no interaction between sex and knowing a victim of sexual assault on RMA.

These results are a promising start to understanding how RMA is influenced. Future studies should continue to investigate what influences students' endorsement of rape myth, and how to decrease those beliefs.

---

#### PRIMARY PRESENTER

---

Jennifer Rose

---

#### STATUS

---

Student – Undergraduate

---

#### CO-PRESENTER

---

Catherine Coogan

---

#### AUTHORS

---

Jennifer Rose

Catherine Coogan

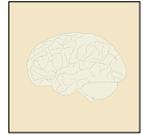
Cynthia Rohrbeck

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Cynthia Rohrbeck



---

## ELLIOTT SCHOOL OF INTERNATIONAL AFFAIRS

---

### Rewarding the Disloyal: BJP Candidate Nominations in the 2014 Indian Elections

In 2014, the Bharatiya Janata Party (BJP) became the first party in thirty years to win an absolute majority in the Indian Parliament. Thereafter, it swept to power in several state elections. On the eve of the national election, but even more so prior to the state elections that followed, a large number of politicians from rival parties joined the BJP. In many instances, the BJP fielded these party-switchers (or defectors) as its candidates in the state elections. Many believe the defectors joined the BJP to maximize their electoral success by benefitting from the party's rising popularity, which is said to have stemmed from the popular campaign led by its Prime Ministerial candidate, Narendra Modi. This study focuses on the state of Maharashtra and examines why the BJP fielded defectors as opposed to longstanding members in an election when it was politically ascendent. The analyses conclude that the BJP nominated candidates on basis of the candidates' potential to win. Internal party surveys revealed that many pre-existing members were unlikely to win, while the defectors were more likely to do so. Using interviews and region-wise analyses of defections across the state, this paper explores those factors that influenced defections that go beyond the general notion that Modi's popularity lured defectors to the BJP.

---

#### PRIMARY PRESENTER

---

Dyutiman Saunik

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHOR

---

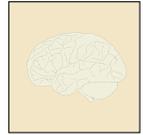
Dyutiman Saunik

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Adam Ziegfeld



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Repetition Priming Preferentially Benefits Infrequent Targets

The process of searching for targets among distractors (i.e., visual search) is affected by a wide array of factors. One known factor is that search performance is improved if a previous search trial contained the same target as the current trial, a phenomenon referred to as repetition priming. Repetition priming has been observed in both pop-out search (e.g., Maljkovic & Nakayama, 1994) and conjunctive search (e.g., Becker, 2008; Kristjánsson & Driver, 2008), yet, much remains unknown about the robustness of this phenomenon. For example, previous instantiations of repetition priming have primarily used small sets of possible targets and distractors. The current investigation used a large array of possible targets and distractors in a complex search environment to test the limits of repetition priming and to explore novel factors that might affect it. Data were drawn from the mobile technology app *Airport Scanner* (Kedlin Co., [www.airportscannergame.com](http://www.airportscannergame.com)), a game wherein players search for prohibited items in simulated images of XRAY baggage. This is an ideal dataset for the current purposes given there are billions of individual trials, millions of unique users, and hundreds of distinct target types. The current study examined whether (1) repetition priming persists across many different targets that range in color, size, and shape; and (2) if individual target frequency (i.e., how often a specific target appears in search) modulates the priming effect. Repetition priming was observed; a target was detected faster if the previous search display contained the same target as opposed to a different target. Target frequency modulated this effect, whereby rarer targets benefited more from repetition priming. These results suggest that repetition priming has direct consequences for complex searches, such as baggage screening, and that repeated exposure to specific targets attenuates this effect.

---

#### PRIMARY PRESENTER

---

Paul Scotti

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHORS

---

Paul Scotti

Stephen Adamo

Stephen Mitroff

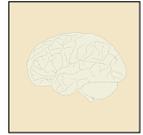
Sarah Shomstein

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Sarah Shomstein



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Adoption of a Multidimensional Approach to Assessing the Impact of Socioeconomic Status on Neurocognitive and Behavioral Outcomes in Pediatric Sickle Cell Disease

Broad neurocognitive deficits have been documented in children with sickle cell disease (SCD), even in the absence of stroke. These deficits pose significant consequences, as lower cognitive abilities are associated with lower academic achievement. However, there has been limited research examining the relationship between neurocognitive functioning and socioeconomic status (SES) in youth with SCD. Given that children with SCD experience socioeconomic disadvantage at higher than usual rates, SES has been posited as one explanation for the high prevalence of neurocognitive issues in SCD. In order to better understand the role of SES, we sought to evaluate the effects of multiple distinct measures of SES on neurocognitive outcomes in pediatric SCD.

Fifty-nine children with sickle cell disease (SCD) ages 7-16 ( $M = 10.44$ ,  $SD = 2.87$ , 42.37 % Male) enrolled in a larger study of the feasibility and efficacy of a computerized cognitive training program. As part of this study, a primary caregiver reported demographic information and rated child executive functioning difficulties on the Behavior Rating Inventory of Executive Function (BRIEF). Caregivers also reported on multiple measures of SES, including the patient's health insurance type (i.e., public or private) and whether the participant received free-or-reduced lunch at school. Children and adolescents completed the Wechsler Intelligence Scale for Children, Fifth Edition (WISC-V).

Multiple regression analyses were performed to examine the relationship between SES measures and performance-based and caregiver-reported neurocognitive and behavioral functioning. Controlling for age and gender, children having public health insurance significantly predicted lower Full Scale IQs on the WISC-V ( $R^2 = 0.158$ ,  $b = -8.609$ ,  $p = 0.021$ ) as well as impairments on the BRIEF working memory ( $R^2 = 0.219$ ,  $b = -9.556$ ,  $p = 0.014$ ) subscale. Whereas, having private health insurance significantly predicted higher Full Scale IQs ( $R^2 = 0.187$ ,  $b = 10.376$ ,  $p = 0.007$ ) and fewer problems on the BRIEF Working Memory ( $R^2 = 0.101$ ,  $b = 7.868$ ,  $p = 0.046$ ) subscale.

In our study, SES significantly predicted performance-based and parent-reported neurocognitive functioning; however, each measure of SES appeared to account for a unique component of SES. Public insurance was a significant predictor of more caregiver-rated problems with working memory and executive function. Findings support the hypothesis that SES plays an important role in determining neurocognitive and behavioral outcomes. Researchers and clinicians should routinely assess SES using various measures to enhance detection of neurocognitive difficulties and assist in crafting tailored interventions to mitigate negative consequences of low SES in children with SCD.

---

#### PRIMARY PRESENTER

---

Isabella Taormina

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHORS

---

Isabella Taormina

Tess Kennedy

Kristina Hardy

Steven Hardy

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Steven Hardy



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Cortical Correlates of Subclinical Antisocial Behaviors

Antisocial disorders, such as psychopathy, are characterized by impairments in social-emotional functioning. Individuals presenting with these disorders are known to have distinct structural, particularly gray matter, brain abnormalities. However, comorbidities (e.g., ADHD, drug use and abuse, etc.) in these clinical disorders can often cloud our understanding of the specific contributions of these behaviors to brain-based atypicalities. Subclinical behaviors associated with antisocial disorders are also present in the general, typically developing population and allow for an unobscured approach to linking brain with these behaviors. The present study investigates links between antisocial traits and cortical structure within a large sample of young adults screened for the presence of psychiatric and neurological impairments. In the current study we correlate variation in a metric of gray matter structure, cortical thickness, across the entire cortex with scores on a measure of antisocial traits, the Self-Report Psychopathy-Fourth Edition-Short Form (SRP4-SF), which is composed of four subtests: Interpersonal, Affective, Lifestyle, and Antisocial. 694 typically developing young adults (280 male: 414 female) completed the questionnaire and provided MRI scans. The CIVET brain-imaging pipeline (v2.0) and SurfStat were used to derive vertex-level cortical thickness values (>80,000 vertices) and complete analyses. Broadly speaking, the results showed thinner cortex in prefrontal areas (e.g., bilateral superior and medial frontal and anterior cingulate cortices) with increasing antisocial traits. These findings complement the current literature on groups with frank antisocial behavior, which are characterized by thinner cortices in these same areas (Yang et al., 2012; Yang et al., 2015). Furthermore, they provide support to the notion that these results generalize to subclinical populations. Since such social-emotional behaviors are continuous and present in the general population, these results may aid the detection and classification of neural endophenotypes that will inform not only our understanding of antisocial disorders, but also the etiology (including genetic underpinnings) of individual differences in social-emotional functioning.

---

#### PRIMARY PRESENTER

Bhairvi Trivedi

---

#### STATUS

Student – Graduate

---

#### AUTHOR

Bhairvi Trivedi

---

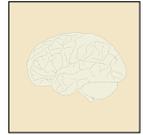
#### RESEARCH MENTOR/ DEPARTMENT CHAIR

Gregory Wallace

---

# SOCIAL SCIENCES

---



---

## SCHOOL OF MEDIA & PUBLIC AFFAIRS

---

### Giving Them Hope: LGBT Activist Rhetoric, 1950-2015

The LGBT rights movement has enjoyed rapid shifts in public opinion as well as a recent series of major policy achievements. This success story provides a fascinating case to study the rhetoric of social movements. This study seeks to trace the evolution of LGBT activists' framing and issue focus from 1950 to 2015. Given existing literature on equality and morality framing, I expected to observe an increase in morality framing and family-focused issues around the turn of the millennium.

A pilot study of 21 speeches and newsletter articles appears to support this hypothesis and warrants further research. In the coming weeks, I will code and analyze a full sample of materials from this time period.

---

#### PRIMARY PRESENTER

---

John Weber

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHOR

---

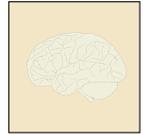
John Weber

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Kimberly Gross



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### Perceived Control as a Mediator of the Association Between Perfectionist Beliefs and Depressive Symptoms in Adolescents

Adolescents' depressive symptoms have been linked with poor academic achievement, diminished social and interpersonal functioning, reduced physical health, and increased risk of substance abuse and suicide (Asarnow et al., 2002; Birmaher et al., 1996; Roberts et al., 2007). Consequently, it is important to understand factors that contribute to adolescent depressive symptoms in order to develop effective interventions. Perfectionist beliefs and perception of control have been linked with adolescent depressive symptoms; however, it is unclear how these function together in relation to depressive symptoms (Enns et al., 2002; Hewitt & Flett, 1993; Rice & Dellwo, 1998). It is possible that both contribute independently to depressive symptoms, or that perceptions of control explain the association between perfectionism and depressive symptoms.

While self imposed (i.e., self-oriented) critical perfectionism and others imposed perfectionism (i.e., socially prescribed) have been associated with increased depressive symptoms, prior research has shown that only socially prescribed perfectionism is associated with less self-control (Klibert et al., 2005). Thus, reduced self-control may mediate the association between socially prescribed perfectionism and depressive symptoms, but not between self-oriented perfectionism and depressive symptoms. However, it is unclear whether this finding with adults applies to adolescents. Perfectionism may be differently associated with control depending on the domain of control. Therefore, this study examined whether perceived control mediates the association between perfectionistic beliefs and depressive symptoms. Given the salience of academics for adolescents, this study focuses on control in the academic domain.

Participants were 439 African American adolescents (mean age = 11.77; 43% female) who reported about socially prescribed and self-oriented perfectionism, perceived academic control, and depressive symptoms in grades 6-8. Linear regression was conducted to test mediation. When prior depressive symptoms and academic control were not taken into account, socially prescribed ( $B = .112, p < .001$ ) and self-oriented perfectionism ( $B = .074, p < .01$ ) in grade 6 were associated with depressive symptoms in grade 8, and academic control was associated with depressive symptoms in grade 8 ( $B = -.201, p < .001$ ). The association between both types of perfectionism in grade 6 and depression in grade 8 was significantly mediated by academic control in grade 7 (self oriented:  $z' = 2.25, p < .05$ ; socially prescribed:  $z' = 2.33, p < .05$ ). However, after accounting for previous depressive symptoms, all associations were reduced to non-significance. In addition, the associations were only significant for females. Results suggest the utility of interventions focusing on perceived academic control in female adolescents.

---

#### PRIMARY PRESENTER

---

Abigail Wolf

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHORS

---

Abigail Wolf

Andrew Gepty

Sharon F. Lambert

Nicholas S. Ialongo

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

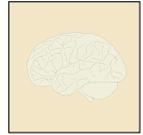
---

Sharon F. Lambert

---

# SOCIAL SCIENCES

---



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### The PTSD Conversation: How Veterans, Service Members, and Civilians Talk about PTSD

As the awareness of Posttraumatic Stress Disorder (PTSD) continues to grow, so does our understanding of its risk factors, biology, and various individual effects. In regards to PTSD's effect on the individual, much of the inquiry is within the psychology discipline. Communication research on PTSD has been relatively insufficient, although it is vital to the creation of effective initiatives aimed at awareness and decreasing stigmas attached to PTSD. Thus, this study explores the PTSD conversation of U.S. military-affiliated personnel—are service members and veterans talking about PTSD, with whom, and how often? Of the veteran and service member responses (n = 71) via an online survey, it was found that they spoke about PTSD significantly more with other military-affiliated friends than with civilian friends. Additionally, veterans and service members reported being significantly more comfortable talking about PTSD with military-affiliated friends than with civilian friends. The results of this study serves as a stepping stone for future research on shaping initiatives and programs, and addressing mental health stigma that acts as a barrier to care.

---

#### PRIMARY PRESENTER

---

Brittany Woodke

---

#### STATUS

---

Student – Undergraduate

---

#### AUTHOR

---

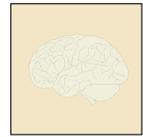
Brittany Woodke

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Katrina Pariera



---

## COLUMBIAN COLLEGE OF ARTS AND SCIENCES

---

### HIV Testing Avoidance: The Relationship Between Perceived Exclusion and HIV Testing Interest Among African American Young Adults

African Americans are disproportionately affected by HIV in the U.S. (CDC, 2017). Knowing one's HIV status is important in order to prevent unknowingly passing on HIV and to get treatment (CDC, 2017). However, 1 in 8 Americans are unaware they are infected (USDHHS, 2017). Furthermore, 55% of people tested do not return to learn their results (Hightow et al., 2013). To prevent the spread of HIV, it is crucial to identify reasons why individuals are not tested. Past research has shown that people's tendency to avoid learning information predicts avoidant behavior (e.g., declining cancer screening, Howell & Shepperd, 2016a). Research also found that avoidance of risk information is more likely following social exclusion (Howell & Shepperd, 2016).

The current study examined associations between avoidance tendencies towards learning one's HIV status, perceived exclusion, and other distinct indicators of HIV testing interest (i.e., anticipated regret of HIV testing, perceived likelihood of testing in the next 6 months, and attitudes toward receiving/learning the results of a free HIV test) in African American young adults. It was anticipated that due to HIV stigma, greater perceived exclusion would be associated with higher avoidance in order to prevent additional exclusion if diagnosed as HIV+. Also, greater avoidance and social exclusion would be associated with less interest in HIV testing. Finally, we compared correlations among those tested for HIV in the past 2 years vs. those not tested not to see if there were differences between groups.

241 African Americans (54% female,  $M_{age} = 24.39$ ) from the D.C. metro area participated in an online survey. Participants reported being non-virgins and never diagnosed with HIV. Demographics, past HIV-testing, avoidance tendencies, perceived exclusion, and unique indicators of HIV testing interest were assessed.

For both young adults who had been tested ( $n = 178$ ) and not tested ( $n = 60$ ) in the past two years, higher testing avoidance was correlated with more anticipated regret for testing in the future. Among those not tested, greater perceived exclusion was related to greater testing avoidance and with anticipated regret towards testing. Finally, for those who had gotten an HIV test in the past two years, greater testing avoidance was associated with less positive attitudes about testing and lower likelihood of testing in the future (all  $ps < .05$ ).

The findings suggest that perceived exclusion and avoidance tendencies may contribute to disinterest in future HIV testing and actual lack in past testing among African American young adults.

---

#### PRIMARY PRESENTER

---

Mali Zaken

---

#### STATUS

---

Student – Undergraduate

---

#### CO-PRESENTER

---

Laura Wolter

---

#### AUTHORS

---

Mali Zaken

Laura Wolter

Brianne K. Molloy

Michelle L. Stock

---

#### RESEARCH MENTOR/ DEPARTMENT CHAIR

---

Michelle L. Stock