WE HAVE VISION

William & Mary
Graduate Arts & Sciences

19th Annual Graduate Research Symposium

March 20–21, 2020

Sadler Center

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William & Mary
Graduate Arts & Sciences

19th Annual Graduate Research Symposium
Schedule at a Glance

Thursday, March 19, 2020 -- Sadler Center

6:30 pm - 8:00 pm	Annual Raft Debate *Commonwealth Auditorium*

Friday, March 20, 2020-- Sadler Center

8:30 am - 9:30 am	Registration *Chesapeake AB*
9:30 am - 10:30 am	Concurrent Sessions *Tidewater A, Tidewater B, Chesapeake C, James Room, York Room*
10:45 am - 11:45 am	Concurrent Sessions *Tidewater A, Tidewater B, Chesapeake C, James Room, York Room*
11:45 am - 1:15 pm	Luncheon, *Chesapeake AB*
12:00 pm - 1:00 pm	Art Therapy *with Sarah Balascio*, *Chesapeake C*
12:00 pm - 12:30 pm	Digital Humanities Workshop, *Tidewater A*
12:10 pm - 12:30 pm	Guided Meditation, *James Room*
12:30 pm - 1:00 pm	Community Engagement Workshop, *Tidewater B*
1:15 pm - 2:15 pm	Concurrent Sessions *Tidewater A, Tidewater B, James Room, York Room*
2:30 pm - 3:30 pm	Concurrent Sessions *Tidewater A, Tidewater B, James Room, York Room*
3:30 pm - 6:00 pm	Poster Presentations/Professional Development and Networking Reception *Chesapeake ABC*

Saturday, March 21, 2020 -- Sadler Center

8:00 am - 8:30 am	Registration *Chesapeake AB*
8:30 am - 11:00 am	Massage Therapy *with Grace Anderson*, *Chesapeake AB*
8:30 am - 9:30 am	Concurrent Sessions *Tidewater A, Tidewater B, Chesapeake C, James Room, York Room*
9:45 am - 10:45 am	Concurrent Sessions *Tidewater A, Tidewater B, Chesapeake C, James Room, York Room*
11:00 am - 12:00 pm	Awards for Excellence in Scholarship Presentations *Tidewater A*
12:00 pm - 1:30 pm	Luncheon & Awards Ceremony *Chesapeake AB*

https://www.wm.edu/as/grs

Dear Members of the William & Mary Community, Visiting Presenters, and Guests,

On behalf of the Graduate Research Symposium organizing committee, I would like to welcome you all to the 19th Annual Arts & Sciences Graduate Research Symposium (GRS) at William & Mary! Over the past 19 years, over 2,500 graduate students from across the country have presented their research to thousands of attendees. This year, 130 graduate students from William & Mary and 17 visiting institutions will add to this distinguished record of excellence in graduate student research.

We have a special event to kick off this year's GRS. The Annual Raft Debate will be held on Thursday, March 19 at 6:30 pm in the Commonwealth Auditorium of Sadler Center. Combining debate with comic relief, this popular event engages the audience to decide which discipline is worth saving in the one-man life raft—unless the devil's advocate beats them to it! The event is free and open to the public, and will also be available to watch on livestream.

The theme of this year's symposium is "We Have Vision." This theme highlights and builds upon William & Mary President Katherine Rowe's campus-wide discussions focused on the future of three of the university's core mission areas: knowledge, service, and creating space for reflection and aspiration. This year we are also encouraging explorations in mental health and stress management via art therapy, massage therapy, and meditation opportunities. To further promote interactions across disciplines, we are combining the Poster Session with a Professional Development Fair. This will provide a variety of resources to students to support their current graduate work and future professional careers. The joint Poster Session/ Professional Development Fair will be held on Friday, March 20 from 3:30-6:00 pm in Chesapeake ABC.

The success of the GRS over the past nineteen years depends on all of the participants and volunteers who make this symposium successful. I would especially like to thank the William & Mary graduate faculty, staff, and administration, and the Graduate Studies Advisory Board for their commitment to graduate students and graduate research. I am also grateful to the GRS organizing committee members for their hard work, dedication, and fresh ideas that have contributed to yet another excellent year!

Best,

Alexis Ohman
2020 Graduate Research Symposium Chair

William & Mary
Graduate Arts & Sciences

WILLIAM & MARY

CHARTERED 1693

OFFICE OF THE PROVOST

Dear Colleagues, Students and Friends,

Welcome to the 19th annual Graduate Research Symposium at William & Mary! It is great to have you here.

Universities expand our knowledge of the world, and W&M students contribute seriously to deeper understanding in many fields on their way to advanced degrees. They then continue to do so as teachers and scholars. This Symposium provides an opportunity for our graduate students and their peers from other schools to present their work and receive comments from people in other departments and schools, as well as the greater William & Mary community. The theme this year is "We Have Vision" and builds upon William & Mary's Vision, Mission and Values statements that create space for reflection and aspiration.

You have my best wishes for an enjoyable and rewarding time together.

Sincerely,

Peggy Agouris
Provost

The Brafferton - P.O. Box 8795- Williamsburg, Virginia 23187-8795
(757) 221-1993 (office) (757) 221-1510 (fax)

2020 Graduate Research Symposium

Program Chair
Alexis Ohman, *Anthropology*

Graduate Student Committee
Jessica Burns, *Biology*
Tomos Evans, *Anthropology*
Heather Kenny, *Biology*
Shaun Richards, *American Studies*
Qi Xia, *Computer Science*

Office of Graduate Studies & Research
Dean Virginia Torczon, *Graduate Studies*
Chasity Roberts
Wanda Carter
Sarah Glosson
Vicki Thompson Dopp

Sponsors
Graduate Studies Advisory Board

Special Thanks To:
Session Chairs
Volunteers and Room Proctors

Judging Panel
Graduate student poster and oral presenters were eligible to submit a paper for award consideration in the disciplinary category of their choosing. The names and institutions of the students and advisors were removed from the submissions prior to evaluation by the judging panel. Advisors whose students submitted papers recused themselves from ranking those papers. All W&M students were eligible for the Graduate Studies Advisory Board and the W&M Awards for Excellence. Only W&M Master's students were eligible for the Carl J. Strikwerda Awards.

Humanities & Social Sciences
Dr. Jamel Donnor, *American Studies*
Prof. Elaine McBeth, *Public Policy*
Dr. Neil Norman, *Anthropology*
Dr. Nicholas Popper, *History*
Dr. Susan Rawles, *Graduate Studies Advisory Board* Dr. Judith Ridner, *Graduate Studies Advisory Board*
Dr. Betsy Sigman, *Graduate Studies Advisory Board*

Natural & Computational Sciences
Dr. David Armstrong, *Physics*
Dr. Robert Barnet, *Psychological Sciences*
Dr. Oscar Javier Chaparro Arenas, *Computer Science*
Dr. Christopher Del Negro, *Applied Science*
Dr. Kerri Dugan, *Graduate Studies Advisory Board*
Dr. Karen Hooker, *Graduate Studies Advisory Board* Dr. Nathan Kidwell, *Chemistry*
Dr. Anh Ninh, *Computer Science*
Dr. David Opie, *Graduate Studies Advisory Board*
Dr. William Soto, *Biology*

S. Laurie Sanderson Mentoring Awards:
Dr. Tuska Benes, *History*
Dr. Eric Bradley, *Applied Science*
Dr. Joseph Jones, *Anthropology*
Dr. Alexandra Joosse, *Public Policy*
Dr. Michelle Lelievre, *American Studies*
Dr. Zhenming Liu, *Computer Science*
Dr. Saskia Mordijck, *Physics*
Dr. Mike Nichols, *Psychological Sciences*
Dr. Bob Pike, *Chemistry*
Dr. Josh Puzey, *Biology*
Dr. Anke Van Zuylen, *COR*

William & Mary
Interdisciplinary Award for Excellence in Research

This award acknowledges the graduate student whose research presentation demonstrates original investigation and the integration of knowledge, and distinguished excellence in scholarship through potential contribution to the discipline and recognition by peers. The top three papers submitted in the category of W&M Humanities and the top three papers submitted in the category of W&M Natural & Computational Sciences competed for the overall Award for Excellence in Research. The papers were judged blindly by an independent panel of William & Mary faculty. The paper by the following student was selected to merit an award among the outstanding submissions.

Justin Estreicher

Ph.D. student - Department of History
Advisor: Dr. Andrew Fisher

"Unoccupied and of a Valuable Kind":
The Georgia Gold Rush and Manufactured Cherokee Savagery

As a Ph.D. student in the department of History at William & Mary, Justin's research focuses on the interactions of Native and Euro-American societies, assimilation policy, and issues of representation and colonial ideologies.

Join Justin as he presents his award winning research
Saturday, March 21, 2020
11:00am-12:00pm in Tidewater A

The Arts & Sciences Graduate Studies Advisory Board at William & Mary is a proud sponsor of the 2020 Graduate Research Symposium

The Graduate Studies Advisory Board is a group of educational, corporate, and community leaders with a commitment to enhancing the quality of graduate education in Arts & Sciences at William & Mary. We commend the attendees of the Graduate Research Symposium for their dedication to excellence in research.

The missions of the Graduate Studies Advisory Board are:

- Development/fundraising to increase graduate Arts & Sciences financial resources
- Assisting in the building of a graduate Arts & Sciences community
- Enhancing professional development opportunities for graduate students
- Advocating for graduate Arts & Sciences within the William & Mary community

Arts & Sciences graduate programs are critical to the mission of William & Mary and to its status as a research university. Graduate programs strengthen the undergraduate program by providing research and mentoring opportunities, and are essential in retaining approximately a third of William & Mary's faculty members in Arts & Sciences.

By sponsoring the 2020 Graduate Research Symposium, initiating the Distinguished Thesis and Dissertation Awards, the Carl J. Strikwerda Awards for Excellence and the S. Laurie Sanderson Awards for Excellence in Undergraduate Mentoring in Arts & Sciences, as well as providing recruitment fellowships to outstanding entering graduate students, the Graduate Studies Advisory Board is playing a vital role in advancing William & Mary's graduate programs in Arts & Sciences.

Members of the Graduate Studies Advisory Board, 2019-20

President: Kathryn Caggiano '90 BS Math
Vice-President: Michael Bracken '86 BS Mathematics
Past President: Robert Saunders '00 BS Physics
Co-chairs, Communications and Advocacy Committee: Jim David '04 MA History, '10 PhD History and Laura J. Terry, '03 BS Biology
Co-chairs, Finance and Development Committee: John D. Burton '89 MA History, '96 PhD History and Eleanor K. Silverman '85 BA Mathematics
Co-chairs, Student Professional Development Committee: David K. Hood '90 BS Chemistry, '92 MA Chemistry, '96 PhD Applied Science and David Opie '88 MS Physics, '91 PhD Physics

Diane Alleva Cáceres '87 BA Economics, '89 MA Government
Kerri Dugan '91 BS Chemistry, '92 MA Chemistry
Kurt Erskine '92 BA Public Policy
Karen Hooker '81 MA Psychology
Carter Hudgins '84 PhD History
Rick Kuhn '76 BA Psychology, '77 MBA
George Miller '67 BS Physics, '69 MS Physics, '72 PhD Physics
Cynthia C. Morton '77 BS Biology
Lauren Onkey '85 BA English/Government
Susan Rawles '05 PhD American Studies
Judith Ridner '88 MA History, '94 PhD History
Betsy Page Sigman '78 BA Government
Gail Williams Wertz '66 BS Biology

Graduate Studies Advisory Board Award for Excellence in Scholarship in the Natural and Computational Sciences

These awards acknowledge William & Mary graduate students whose research presentation demonstrates original investigation and the integration of knowledge, and distinguished excellence in scholarship through potential contribution to the discipline and recognition by peers.

To be considered for an award, presenters had to submit a 5-6 page paper describing their research. The papers were judged blindly by an independent panel of William & Mary faculty and Graduate Studies Advisory Board members. The papers by the following students were selected to merit an award among the many outstanding submissions. The corporate sponsored awards listed below were open to students from William & Mary.

Eden Maness

Ph.D. Candidate - Department of Applied Science
Advisor: Dr. Josh Burk
The Antipsychotic Potential of Orexin Receptor Inhibitors for the Treatment of Schizophrenia

As a Ph.D. candidate in the department of Applied Science at William & Mary, Eden's dissertation research explores the underlying neurobiology of attentional processing and performance through a clinical lens.

Join Eden as she presents her research
Saturday, March 21, 2020
11:00am-12:00pm in Tidewater A

Graduate Studies Advisory Board Award for Excellence in Scholarship in the Humanities and Social Sciences

These awards acknowledge William & Mary graduate students whose research presentation demonstrates original investigation and the integration of knowledge, and distinguished excellence in scholarship through potential contribution to the discipline and recognition by peers.

To be considered for an award, presenters had to submit a 5-6 page paper describing their research. The papers were judged blindly by an independent panel of William & Mary faculty and Graduate Studies Advisory Board members. The papers by the following students were selected to merit an award among the many outstanding submissions. The corporate sponsored awards listed below were open to students from William & Mary.

Tomos Evans

Ph.D. student - Department of Anthropology
Advisor: Dr. Neil Norman

What Civilizations do the Forests Conceal? Prospects of Laser Scanning in Surveying Archaeological Landscapes in Nigeria

As a Ph.D. student in the department of Anthropology at William & Mary, Tomos' research revolves around understanding the nature, organization and ontologies of past societies in southwestern Nigeria and how these influenced their engagement with the landscape, with specific regard to monumental earthwork construction.

Join Tomos as he presents his research
Saturday, March 21, 2020
11:00am-12:00pm in Tidewater A

Award Recipients for Excellence in Scholarship

William & Mary Award for Excellence in the Humanities & Social Sciences

ALEXIS OHMAN
Anthropology, Advisor: Dr. Jennifer Kahn
Rations and Recreation: Comparative Zooarchaeology at Betty's Hope Plantation and Shirley Heights Fort in Antigua, WI

William & Mary Honorable Mention

JENNIFER MOTTER
History, Advisor: Dr. Karin Wulf
The Role of Knowledge in Commodification: Salt Production in the Early Modern Dutch Atlantic

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Visiting Scholar Award for Excellence in the Humanities & Social Sciences

ROBERT M. MANZO
History, Western Carolina University, Advisor: Dr. Alexander Macaulay
The Development of Public Libraries in North Carolina, 1895-1941

Visiting Scholar Honorable Mention

DANIEL AFFSPRUNG
Cultural Studies, Dartmouth College, Advisor: Dr. James Dobson
Big Data and the Communication Metaphor:
What if the Data Speaks for Itself?

Award Recipients for Excellence in Scholarship

William & Mary Award for Excellence in the Natural, Computational, and Psychological Sciences

HEATHER KENNY
Biology, Advisor: Dr. Dan Cristol
Investigating the Interaction Between Noise Pollution and Behavioral Traits in Eastern Bluebirds

William & Mary Honorable Mentions

JESSICA BURNS
Biology, Advisor: Dr. Paul Heideman
Changes in Study Methods, Problem-Solving, and Motivation After Instruction in Sketching in

AMY HUGHES
Biology, Advisor: Dr. Joshua Puzey
A Falling Monarchy: Do Insecticides Hinder Flight Capabilities of the Monarch Butterfly?

Visiting Scholar Award for Excellence in the Natural, Computational, and Psychological Sciences

SEAN WOMACK
Clinical Psychology, University of Virginia, Advisor: Dr. Melvin Wilson
Causal Effects of Environmental Instability in Early Childhood on the Development of Disruptive Behaviors into Adolescence

Carl J. Strikwerda Awards for Excellence

These awards recognize W&M Arts & Sciences graduate students for an outstanding written paper by a student who is engaged in thesis research/scholarship to earn an MA, MS, or MPP degree. In the spring of 2011, the Arts & Sciences Graduate Studies Advisory Board voted unanimously in support of the Board's concept for initiating these annual awards. To be considered for an award, Graduate Research Symposium presenters had to submit a 5-6 page paper describing their research. The papers were judged blindly by an independent panel of William & Mary faculty and Graduate Studies Advisory Board members. Awardees are listed in alphabetical order.

Award for Excellence in the Humanities and Social Sciences

TYLER GOLDBERGER
History Department, M.A./Ph.D.
Advisor: Dr. Betsy Konefal

Awards for Excellence in the Natural, Computational, and Psychological Sciences

DELANEY COSTANTE
Biology Department, M.S.
Advisor: Dr. Matthias Leu

NYX ROBEY
Psychological Sciences Department, M.S.
Advisor: Dr. Cheryl Dickter

Carl J. Strikwerda Awards for Excellence

Sessions Featuring:

Friday, March 20th at 2:30 p.m. - Tidewater A
Endangered Species Act: Quantifying Threats Affecting Species
Delaney Costante, Biology

Friday, March 20th at 2:30 p.m. - James Room
e-Cultural Competence for U
Nyx Robey, Psychological Sciences

Saturday, March 21st at 8:30 a.m. - York Room
Reinscribing Memory in a Mausoleum: The Valley of the Fallen and the Polarized Political Landscape in Spain
Tyler Goldberger, History

S. Laurie Sanderson Awards for Excellence in Undergraduate Mentoring

This award recognizes mentoring in the context of undergraduate scholarship and research outside of classroom teaching, and is intended to complement the Teaching Assistant awards offered within some graduate programs. Such mentoring outside the classroom might include, among other examples, graduate students who mentor undergraduates in the context of undergraduate students' senior theses, honors theses, writing projects, term papers, or research in a laboratory, field site, museum, archive, or campus project.

Nominations consist of a nomination form from a current or past W&M undergraduate student, and a second nomination form from a current or past W&M faculty member. A panel of W&M faculty members ranked the nominations. Awardees are listed in alphabetical order.

Award for Excellence in Undergraduate Mentoring in the Humanities and Humanistic Social Sciences

TAYLOR TRIPLETT
Anthropology Department, M.A./Ph.D.
Advisor: Dr. Martin Gallivan

Awards for Excellence in Undergraduate Mentoring in the Natural, Computational, and Psychological Sciences

JESSICA BURNS
Biology Department, M.S.
Advisor: Dr. Paul Heideman

DARYL HESSE
Psychological Sciences Department, M.S.
Advisor: Dr. Danielle Dallaire

HEATHER KENNY
Biology Department, M.S.
Advisor: Dr. Dan Cristol

S. Laurie Sanderson Awards for Excellence in Undergraduate Mentoring

Sessions Featuring:

Friday, March 20th at 1:15 p.m. - Tidewater A
Investigating the Interaction Between Noise Pollution and Behavioral Traits in Eastern Bluebirds
Heather Kenny, Biology

Saturday, March 21st at 8:30 a.m. - Tidewater B
Changes in Study Methods, Problem-Solving, and Motivation After Instruction in Sketching in an Introductory Biology Course
Jessica Burns, Biology

Saturday, March 21st at 8:30 a.m. - James Room
Role of Calcium Activity During Early Neural Development
Daryl Hesse, Psychological Sciences

**Taylor Triplett is not presenting at the GRS


WILLIAM & MARY
CHARTERED 1693
Four William & Mary faculty members from diverse disciplines are stranded on a desolate island with only a one-person life raft to escape to civilization. Who should survive for the sake of humanity?
THE ANNUAL
RAFT DEBATE
David Grandis
for the Humanities
Jennifer Stevens
for the Social Sciences
Joshua Erlich
for the Sciences
Joshua Gert
as the Devil's Advocate
Virginia Torczon
as the Judge
THURSDAY, MARCH 20, 2020 @ 6:30PM
SADLER CENTER, COMMONWEALTH AUDITORIUM
The Debate is free and open to the public.
Sponsored by the Office of Graduate Studies & Research

Eyes on the Prize!

GRS 2020 Raffle

How can you win?

- For each session you attend, you will receive one ticket from the session proctor or chair.
- Turn in your tickets to the registration desk.
- There will be THREE drawings: Friday at 12pm, Friday at 4pm, and Saturday during the award luncheon in Chesapeake ABC
- 15 total prizes will be awarded.
- Prizes include laser pointers, W&M memorabilia, computer accessories, etc.

****Must be present to win!****

Friday, March 20, 2020
12-1pm
Chesapeake C

Stressed out? Experience the therapeutic value of making art with a board certified art therapist.

Experiment with mandala coloring pages, modeling clay and painting supplies.

No art experience necessary.

Promote Yourself and Your Research Online!

Friday, March 20, 2020
12:00-12:30
Tidewater A

Are you interested in networking and publishing online? Join us for a lunch- time workshop to learn about promoting yourself and your research online. We will be discussing current options for hosting a personal website and publishing text-/archival-based research in today's digital age.

Jennifer Ross is a graduating Ph.D. candidate in American Studies and has worked on various digital humanities topics including GIS, Omeka archives, and Scalar digital publishing. After her defense this spring, she will serve as the Digital Humanities Postdoctoral Fellow at the University of Toronto.

19th ANNUAL GRADUATE RESEARCH SYMPOSIUM

Guided Meditation
12:10pm - 12:30pm
Friday, March 20, 2020

All are welcome to take a peaceful break from the day and sit for a brief guided meditation at 12:10pm in the James Room of Sadler Center. No experience necessary.

Please join Humphrey and Louie during the
Poster Presentations & Professional Development
on Friday, March 20, 2020
from 3:30pm-4:30pm in Chesapeake ABC

Massage Therapy
9:00am - 11:00am
Saturday, March 21, 2020

All are welcome to take a peaceful break from the day and enjoy a free 5-minute chair massage with Grace Anderson in Chesapeake ABC.

Grace has been a self contracted certified massage therapist since 2000, offering various modalities such as Swedish, Tui-Na, deep tissue and prenatal massages. She has also served as a massage therapy instructor at American Spirit Institute. Email wellness@wm.edu or call 757-221-6435 with questions about massage therapy at W&M.

William & Mary
Graduate Arts & Sciences

19th Annual Graduate Research Symposium
Friday, March 20, 2020

Highlighted names indicate award winners

	Tidewater A	Tidewater B	Chesapeake C	James Room	York Room
9:30-10:30	Daniel Borrus	Lauren Emerson	Savannah Cuozzo	Christina Marlow	Joshua Lipson
	Cameron Grover	Marco Merchand	Tangereen Claringbold	Claudia Escue	Paul Elizalde
	Winson Ye	Haoyue Jiang	Colin Egerer	Alexis Ohman	Peter Varga
	Sudip Paudel	Ryan Chaban			

	Tidewater A	Tidewater B	Chesapeake C	James Room (10:45-12:00)	York Room
10:45-11:45	Patrick McArdle	Caroline Schlutius	Jeremy Myers	Jennifer Motter	Shaun Richards
	Jesse Ingham	Megan Moran	Zeyi Tao	Eric Hollander	Robert Manzo
	Richard Reksoatmodjo	Fatima Quddos	Christopher Chamness	Kaila Schwartz	Grover Conner
	Ezekiel Wertz	Yasaman Setayeshpour		Xavier McClean	

11:45-1:15 Luncheon - Chesapeake AB

12:00 pm - 1:00 pm Art Therapy *with Sarah Balascio- Chesapeake C*

12:00 pm - 12:30 pm Digital Humanities Workshop - *Tidewater A*

12:10 pm - 12:30 pm Guided Meditation - *James Room*

12:30 pm - 1:00 pm Community Engagement Workshop - *Tidewater B*

Presenters are listed in order of appearance
Revised 03/09/2020

William & Mary
Graduate Arts & Sciences

19th Annual Graduate Research Symposium
Friday, March 20, 2020
Highlighted names indicate award winners

1:15-2:15

Tidewater A
Ethan Brewer
Timothy Boycott
Robin Thady
Heather Kenny

Tidewater B
Joseph Cuozzo
Nikunjkumar Prajapati
Christopher Johnson

James Room
William Ferris
Bennett Herson-Roeser

York Room
Daniel Affsprung
Adrienne Resha
Eileen Xing

2:30-3:30

Tidewater A
Amy Hughes
Delaney Costante
Amanda Guthrie
Casey McLaughlin

Tidewater B (2:30-3:45)
Dinidu Perera
Anyang Hu
Scott Madaras
Avishi Abeywickrama
David Lahneman

James Room (2:30-3:45)
Annabelle Bass
Caroline Jordan
Nyx Robey
Laura Brugger
Bendu Jackson

3:30-5:30 **Poster Presentation and Networking Reception - Chesapeake ABC**

Presenters are listed in order of appearance
Revised 03/09/2020

William & Mary
Graduate Arts & Sciences

19th Annual Graduate Research Symposium
Saturday March 21, 2020

Highlighted names indicate award winners

8:30-9:30

Tidewater A	Tidewater B	Chesapeake C	James Room (8:30-10:00)	York Room
Seth Goodman	Tianfang Yang	Victoria Owen	Daryl Hesse	Mitchell Oxford
Amanda Watson	Ye Dam Yi	Shuangli Du	Sean Womack	Jonathan Honig
Qi Xia	Jessica Burns	Felipe Ortega Gama	Ti Hsu	Tyler Goldberger
Sunil Manandhar		Andrew Rotunno	Seunghyun Shin	
			Nicholas Surdel	

9:45-10:45

Tidewater A	Tidewater B	Chesapeake C	York Room
Mohamed Ibrahim	Elizabeth Ransone	Caleb Burns	Edward Pomykaj
Hongyuan Liu	Jason Freeman	Yuxin Zhang	Rebekah Planto
Gurunath Kadam	Amy Northrop	Ben Skopic	Chester Pelsang
Lishan Yang		Huw Richards	

11:00-12:00 W&M Awards for Excellence in Scholarship Presentations - Tidewater A

W&M Interdisciplinary Award for Excellence in Research -- Justin Estreicher
W&M Award for Excellence in the Natural and Computational Sciences – Eden Maness
W&M Award for Excellence in the Humanities and Social Sciences – Tomos Evans

12:00-1:30 Luncheon & Awards Ceremony - Chesapeake AB

Presenters are listed in order of appearance
Revised 03/09/2020

19th Annual Graduate Research Symposium
Detailed Schedule
Friday, March 20, 2020

Friday 9:30 AM

TIDEWATER A — New Looks at Networks I

Rhythmicity in a Neural Network Model based on Recurrent Synaptic Excitation and Synaptic Depression
Daniel Borrus (William & Mary)

Successive Photonic Ablation as an In Vitro Model of Neurodegenerative Disorders
Cameron Grover (William & Mary)

DreamWalk: Fine-Grained, Brain-Controlled VR Traversal
Winson Ye (William & Mary)

Analysis of Spatiotemporal Pattern of Calcium Spikes in the Neural Plate of Xenopus laevis
Sudip Paudel (William & Mary)

TIDEWATER B — Choose the Light Side or the Dark Side

The Effect of Lighting Conditions on the Likelihood of Bird-Window Collisions
Lauren Emerson (William & Mary)

Dark Matter constraints on the Inert three Higgs doublet
Marca Merchand (William & Mary)

Near-field Infrared Spectroscopy of Heterogeneous Media
Haoyue Jiang (William & Mary)

Stereoscopic Fast Camera Diagnostic Validation for Scrape-Off layer Filament Statistics MAST
Ryan Chaban (William & Mary)

CHESAPEAKE C — Quirk and Quantum

Enhanced Quantum Noise Suppression via Spatial Beam Optimization
Savannah Cuozzo (William & Mary)

Quirks of QCD: Twist-2 Operators on the Lattice
Tangereen Claringbold (William & Mary)

Parton Distribution Functions from Lattice QCD
Colin Egerer (William & Mary)

JAMES ROOM — Food Fights

Approach and Avoidance Behaviors Toward Food in Neophobic Children
Christina Marlow (William & Mary)

Preliminary Explorations of Traditional Taro Farming in Rurutu, French Polynesia
Claudia Escue (William & Mary)

Rations and Recreation: Comparative Zooarchaeology at Betty's Hope Plantation and Shirley Heights Fort in Antigua, WI
Alexis Ohman (William & Mary)

denotes award winner

19th Annual Graduate Research Symposium
Detailed Schedule

Friday 9:30 AM

YORK ROOM — Topics in Mental Health and Cognition

Does Absorption Predict Responses to Mental Health Interventions?
Joshua Lipson (William & Mary)

Identifying Loss-of-Function Mutants that Confer Resistance to Antidepressants in *Saccharomyces cerevisiae*
Paul Elizalde (The Catholic University of America)

Lumping and Splitting: Cognitive Style and Personality in Daily Life
Peter Varga (William & Mary)

Friday 10:45 AM

TIDEWATER A — Getting Physic-al

Surface Phonon-Polaritons In Isotropic and Anisotropic Media
Patrick McArdle (William & Mary)

Synthesis, Separation, and Characterization of Aqueous Colloidal Suspensions of Fullerene Epoxide
Jesse Ingham (Western Carolina University)

SOLPS Study of the Roles of Fueling and Plasma Transport on Setting the Density Pedestal in High Opacity Experiments on C-Mod
Richard Reksoatmodjo (William & Mary)

Understanding Beam Current Monitor Double Differences and Minimizing Noise that Leads to False Asymmetries
Ezekiel Wertz (William & Mary)

TIDEWATER B — Case Studies in Biology

Speciation Dynamics of Diverging Monkeyflower
Caroline Schlutius (William & Mary)

Population Structure, Gene Flow, and Conservation of Townsend's Big-eared Bat (*Corynorhinus townsendii*) Throughout Nevada
Megan Moran (Christopher Newport University)

Effect of Cortisol Treatment *in Vivo* on Immune Response and Infection Prevalence in Rainbow Trout
Fatima Quddos (William & Mary)

Biology of Robustness: SUMO & the Stress Tolerance in Yeast
Yasaman Setayeshpour (William & Mary)

19th Annual Graduate Research Symposium
Detailed Schedule

Friday 10:45 AM

CHESAPEAKE C — New Looks at Networks II

A Hybrid Incremental Singular Value Method
Jeremy Myers (William & Mary)

Neuron Manifold Distillation for Edge-Cloud Deep Learning Systems
Zeyi Tao (William & Mary)

Invertible Neural Networks: Generative Model for Markov Chain Monte Carlo Sampling of Lattice Field Theories
Christopher Chamness (William & Mary)

JAMES ROOM (10:45 – 12:00) — Musings on Meanings

The Role of Knowledge in Commodification: Salt Production in the early Modern Dutch Atlantic
Jennifer Motter (William & Mary)

Reckless Mimesis: Identifying Causality in Transcendental Song and Story
Eric Hollander (Brandeis University)

The Name's the Same, but the Meaning's Not: Naming and Multiple Puritan Identities in Massachusetts's First Settler Families
Kaila Schwartz (William & Mary)

Establishing Provenance and Analysis of King Wak Chan K'awiil's Bowl
Xavier McClean (University of Miami)

YORK ROOM — Reading Jim Crow

"Let the Doctor Alone": Symbolic Lynching in Charles W. Chesnutt's *The Marrow of Tradition* (1901)
Shaun F. Richards (William & Mary)

The Development of Public Libraries in North Carolina, 1895-1941
Robert Manzo (Western Carolina University)

Jim Crow Education and the Formation of Racially Segregated Deaf Communities in Twentieth Century Virginia
Grover J. Conner (William & Mary)

11:45AM – 1:15PM Lunch, Chesapeake A/B

12:00PM - 1:00 PM Art Therapy, Chesapeake C

12:00PM - 12:30PM Digital Humanities Workshop, Tidewater A

12:10PM - 12:30PM Guided Meditation, James Room

12:30PM - 1:00PM Community Engagement Workshop, Tidewater B

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FRIDAY 1:15PM

TIDEWATER A — Tap for Sound

Global Shipping Container Monitoring Using Machine Learning with Multi-Sensor Hubs and Catadioptric Imaging
Ethan Brewer (William & Mary)

Using Acoustic Signals to Reduce the Incidence of Avian Collisions with Human-Made Structures in Open Air-Space.
Timothy Boycott (William & Mary)

Developing an Acoustic Warning Signal to Reduce Bird Collisions
Robin Thady (William & Mary)

Investigating the Interaction Between Noise Pollution and Behavioral Traits in Eastern Bluebirds
Heather Kenny (William & Mary)

TIDEWATER B — Quantum Queries

Transport Properties of Hybrid Junctions in Quantizing Magnetic Fields
Joseph Cuozzo (William & Mary)

Application of Quantum Correlated Twin-Beams to Enhance Optical Communications
Nikunjkumar Prajapati (William & Mary)

π-π Scattering from Lattice Quantum Chromodynamics
Christopher Johnson (William & Mary)

JAMES ROOM— Framing Farming

Development of a Kite Aerial Photography Imaging Procedure to Expand GIS Analysis to Farmers Under Resource Constraints
William Ferris (Virginia Tech)

"Those Claiming the Rights of Free Men are Themselves the Most Execrable of Tyrants"
Bennett Herson-Roeser (William & Mary)

YORK ROOM — Comic Books, Clay Tablets, and the Computational Turn

Big Data and the Communication Metaphor: What if the Data Speaks for Itself?
Daniel Affsprung (Dartmouth College)

Dawn of #XSpoilers: Reading Hashtags as Digital Paratexts
Adrienne Resha (William & Mary)

Squaring the Circle: Using Isotope to Radicalize Cuneiform Characters
Eileen Xing (Brandeis University)

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FRIDAY 2:30PM

TIDEWATER A — Effects on Ecologies

A Falling Monarchy: Do Insecticides Hinder Flight Capabilities of the Monarch Butterfly?
Amy Hughes (William & Mary)

Endangered Species Act: Quantifying Threats Affecting Species
Delaney Costante (William & Mary)

Enhancing Coastal Resiliency through Integrating People and Ecosystems: A Tale about Living Shorelines
Amanda Guthrie (Virginia Institute of Marine Science)

Mercury, Stress, and Feather
Casey McLaughlin (William & Mary)

TIDEWATER B (2:30 – 3:45) — Materials and Methods

Characterization and Modeling of the Mechanical Anisotropy of Recluse Silk
Dinidu Perera (William & Mary)

Chemical Transformation of Tungsten Oxides as Ion Intercalating Electrochromic Materials
Anyang Hu (Virginia Tech)

Photocurrent Time Responses of VO_2 on TiO_2:Nb and Its Comparison to Ultrafast Photo Induced Insulator to Metal Transition
Scott Madaras (William & Mary)

Measurements of Graphene Interfacial Forces Using AFM Colloidal Probe Technique
Avishi Abeywickrama (William & Mary)

Emergent Properties in Films of Transition Metal Oxides
David Lahneman (William & Mary)

JAMES ROOM (2:30 – 3:45) — All Sorts of Systems

Sentencing Decisions of Accused Offenders: Interracial Contact, Criminality Stereotypes, and Racial Bias
Annabelle Bass (William & Mary)

Investigation of the Relational Mobility Scale's Predictive Utility and Validity
Caroline Jordan (William & Mary)

e-Cultural Competence for U
Nyx Robey (William & Mary)

Discrimination, Cultural Heritage & Ethnic Identity Among Immigrants from Spanish-speaking Latin American Countries
Laura Brugger (Saint Louis University)

Non-Social vs. Social Jobs: Employment Biases Towards Autistic Individuals
Bendu Jackson (William & Mary)

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FRIDAY 3:30-5:30 POSTER PRESENTATIONS – CHESAPEKAE ABC

1. Madeleine Bassett, William & Mary, Anthropology
2. Amanda Chappell, West Virginia University, Psychology
3. Alexandra Combates, Virginia Tech, Material Cultures and Public Humanities
4. Kayla Copeman, William & Mary, Chemistry
5. Kimberly Elliott, The Catholic University of America, Psychological Science
6. Candace Gray, Morgan State University, History
7. Emma Hepworth, William & Mary, Biology
8. Luke Herchenroeder, William & Mary, Psychological Sciences
9. Matthew Kane, William & Mary, Biology
10. Matthew Kessler, William & Mary, Chemistry
11. Spencer Kirn, William & Mary, Applied Science
12. Jade Kline, Virginia Tech, Educational Research and Evaluation
13. Amanpreet Kohli, Virginia Institute of Marine Science, Aquatic Health Sciences
14. Katie McCormack, Vanderbilt University, Anthropology
15. Alexandria Mead, William & Mary, Anthropology
16. Molly Miller, William & Mary, Psychological Sciences
17. Lori Neri, Western Carolina University, Chemistry
18. Elisabeth Polanshek, William & Mary, Biology
19. Hannah Przelomski, William & Mary, Chemistry
20. Jaclyn Rebstock, William & Mary, Chemistry
21. Margaret Rooney, William & Mary, Applied Science
22. Elizabeth Skinner, William & Mary, Applied Science
23. Matthew Sturner, William & Mary, Chemistry
24. Hannah Tofil, William & Mary, Biology
25. Juselyn Tupik, Virginia Tech -Maryland College of Veterinary Medicine, Biomedical & Veterinary Sciences
26. Jessie Turner, Virginia Institute of Marine Science, Physical Sciences
27. Emma Wedell, William & Mary, Psychological Sciences
28. Luis Zazueta Reyes, William & Mary, Physics

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Saturday, March 21, 2020

Saturday 8:30 AM

TIDEWATER A — Man and Machine

Using Machine Learning to Predict Non Permissive Environments in Nigeria
Seth Goodman (William & Mary)

Magneto: Joint Motion Analysis Using an Electromagnet-Based Sensing Method
Amanda Watson (William & Mary)

FABA: An Algorithm for Fast Aggregation against Byzantine Attacks in Distributed Neural Networks
Qi Xia (William & Mary)

Towards a Natural Perspective of Smart Homes for Practical Security and Safety Analyses
Sunil Manandhar (William & Mary)

TIDEWATER B — Cognitive Engagements

Exploring Personality Profiles Across Different Political Regions: An Application of Latent Profile Analysis
Tianfang Yang (William & Mary)

In Another's Shoes: Visceral Emotional Experiences in Decisions for Self and Others in Risky Decision Making
Ye Dam Yi (Wake Forest University)

Changes in Study Methods, Problem-solving, and Motivation after Instruction in Sketching in an Introductory Biology Course
Jessica Burns (William & Mary)

CHESAPEAKE C — Put a Spin On It

Neutron Skins of Heavy Nuclei
Victoria Owen (William & Mary)

Progress Towards an Ultracold Trapped Atom Interferometer
Shuangli Du (William & Mary)

Two-Body Matrix Elements for Arbitrary Spin Particles
Felipe Ortega Gama (William & Mary)

Progress Towards Spin-Dependent Radio Frequency Trapping for Ultracold Atoms
Andrew Rotunno (William & Mary)

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Saturday 8:30 AM
JAMES ROOM — Psychology Today

Externalizing Behaviors in Children with Incarcerated Parents
Daryl Hesse (William & Mary)

Causal Effects of Environmental Instability in Early Childhood on the Development of Disruptive Behaviors into Adolescence
Sean Womack (University of Virginia)

Psychological Distress, Mindfulness, and Emotional Eating
Ti Hsu (William & Mary)

American Pragmatism in the Postmodern World: A.R. Ammons and Ecopoetry
Seunghyun Shin (University of Vermont)

How State-Level Variables Interplay with Personality's Relationship to Political Orientation
Nicholas Surdel (William & Mary)

YORK ROOM — Resources and Religion

"Mass Demonstrations: Catholic Ritual as Political Theater at the End of the Napoleonic Wars"
Mitchell Oxford (William & Mary)

Of Democracies, Dictatorships, and Resource Deposits
Jonathan Honig (University of Tennessee)

Reinscribing Memory in a Mausoleum: The Valley of the Fallen and the Polarized Political Landscape in Spain
Tyler Goldberger (William & Mary)

Saturday 9:45 AM TIDEWATER A — Good Times with GPUs

Analyzing and Leveraging Remote-core Bandwidth for Enhanced Performance in GPUs
Mohamed Ibrahim (William & Mary)

Why GPUs are Slow at Executing NFAs and How to Make them Faster
Hongyuan Liu (William & Mary)

BCoal: Bucketing-based Memory Coalescing for Efficient and Secure GPUs
Gurunath Kadam (William & Mary)

Accurate and Fast Estimation of Input-Dependent GPGPU Application Resilience
Lishan Yang (William & Mary)

TIDEWATER B — Pathogens and Predictions

Prophages Play a Role in Strain-Level Specificity in a Host-Microbe Association
Elizabeth Ransone (University of Tennessee)

Pathogen Prevalence as a Predictor of Interracial Marriage
Jason Freeman (William & Mary)

Targeting DDI2 to Potentiate Proteasome Inhibitor-Induced Cell Death in Triple Negative Breast Cancer Cells
Amy Northrop (Virginia Commonwealth University)

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Saturday 9:45 AM
CHESAPEAKE C — Imagining Improvements

Synthesis and Characterization of Naphtochromene Derivatives Utilizing a Recently Developed Cascade Reaction
Caleb Burns (William & Mary)
The Influence of Overcharging Protocol in the Aqueous Battery System
Yuxin Zhang (Virginia Tech)
Bioinspired Toughness Enhancing Architectures for Thin Films and Fibers
Ben Skopic (William & Mary)
Impact of Aggregation on the Electron Injection of Eosin Y in Dye-Sensitized Solar Cells
Huw Richards (William & Mary)

YORK ROOM — Behind the Curtain
"No Halo:" Consent and the Politics of Systematic Rape in *Charlotte Temple* and *Tess of the D'Urbervilles*
Edward Pomykaj (University of Vermont)
Keeping Time: Temporality, Memory and Distributed Personhood in a Concealed Assemblage from Bacon's Castle
Rebekah Planto (William & Mary)
Labor in Colonial Virginia: How Women Tavernkeepers Typified Gendered "Professionalship," 1750-1795
Chester Pelsang (George Mason University)

11:00-noon

TIDEWATER A — W&M AWARDS FOR EXCELLENCE

"Unoccupied and of a Valuable Kind": The Georgia Gold Rush and Manufactured Cherokee Savagery
Justin Estreicher (William & Mary)
The Antipsychotic Potential of Orexin Receptor Inhibitors for the Treatment of Schizophrenia
Eden Maness (William & Mary)
What Civilizations do the Forests Conceal? Prospects of Laser Scanning in Surveying Archaeological Landscapes in Nigeria
Tomos Evans (William & Mary)

SATURDAY 12:00 PM Chesapeake A/B – AWARDS LUNCHEON

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Big Data and the Communication Metaphor: What if the Data Speaks for Itself?

Presenter: Daniel Affsprung
Advisor: James Dobson
Dartmouth College,
Cultural Studies

Big data is much discussed in business, government, and healthcare, but the ascendance of the data-driven approach has consequences beyond these areas, detectable in both discourse and cultural practices such as self-quantification. The questions explored in this work, “Can the data speak for itself?” and “Can the data speak for us?” are sparked by discourse which positions data or numbers as a communicator or speaker. The conceptual metaphor evinced by these enunciations (e.g. “The numbers speak for themselves”, “What does the data tell you?”) is articulated in this work and critically examined as a supporting element of big data’s claims to objectivity. That objectivity, relying as it does on the denial of human subjectivity, intention, and interpretation, becomes especially problematic in cases where the data being examined is generated by human action. Such cases employ a kind of knowledge production Antoinette Rouvroy calls data behaviorism, which crucially alters the way subjects are formed by rendering individual motivations and narratives secondary to predictive quantitative models. This work examines the data behaviorist change in subjectivation together with critical analysis of quantified self practices in the workplace and Foucauldian understandings of neoliberalism. By looking at how data has come to speak for us, this paper evaluates the risk of diminished reflexive capacities in subjects as self-knowledge and self-expression become deficient in comparison to a-signifying mnemotechnics which create user profiles or 'data doubles'.

Daniel Affsprung is a second-year MALS student at Dartmouth College. His B.A. is in English Literature, with a minor in Creative Writing. His areas of interest include poetry, media theory, and critical theory. Daniel’s thesis work at Dartmouth is in the field of Critical Data Studies.

Mapping “Muleskinner News”: Bluegrass Music, Identity, and Place from 1970-1973

Presenter: Alexandra Hallie Combates
Advisor: Jordan Laney
Virginia Tech,
Material Cultures and Public Humanities

Using digital mapping and archival methods, this research examines and documents the geographic proliferation of bluegrass music performances from 1970-1973. Utilizing the bluegrass trade publication, Mulekskinner News, performance locations are mapped allowing for a better understanding of the geographic locations of bluegrass fanbases and communities from 1970-1973. Theories of place and identity are used to analyze the connections between bluegrass music performance and their frequency over time and space. Findings and resulting research avenues are particularly applicable to questions concerning the relationship between bluegrass music and the Appalachian region.

Alex Combates is currently a graduate research assistant at Virginia Polytechnic Institute and State University and will earn her Master’s in Material Culture and Public Humanities program in May 2020. Alex’s future projects include creating online exhibitions and research concerning digital humanities platforms. Using open access programs, Alex seeks to bring the worlds of material cultures, education, and research to the public sphere.

Reckless Mimesis: Identifying Causality in Transcendental Song and Story

Presenter: Eric Hollander
Advisor: Emily Frey
Brandeis University,
Musicology

The following presentation will begin with a brief introduction to the specific identity of interartistic expression in the late 19th century and the significance with which it applies to analyses of European and American expressions. Then, a certain shortcoming in the binary model that previous scholarship has typically applied will be exposed: specifically, its negligence of music and causality. Finally, two Transcendentally inspired American compositions will be witnessed in interartistic enjambments in what will be acknowledged as an interart triage in order to substantiate representations of causality in 19th century artistic trends and frame an interpretation of its significance. This comparative analysis will feature Henry David Thoreau's, *A Walk to Wachusett* and Charles Ives', "Tom Sails Away" from *19 Songs* as a prime specimen. The purpose of this study is twofold: both yielding a specific identification of music's place in the hierarchy of artistic paragons and revealing an exemplary musical voice as representative of musical Realism in America. This second is admittedly more complex and therefore merits considerable discussion as the conceptual thread is transported from Europe to America, translated from Realism to Transcendentalism, transformed from dialogue to trialogue, and transubstantiated from subjective emotion to awareness of causality.

Eric Hollander is a Ph.D. candidate in Musicology at Brandeis University. His research is focused on musical realizations of poetic texts and oral traditions.

"No Halo": Consent and the Politics of Systematic Rape in *Charlotte Temple* and *Tess of the D'Urbervilles*

Presenter: Edward Richard Pomykaj
Advisor: Elizabeth Fenton
University of Vermont,
English

One hundred years after Rowson's *Charlotte Temple* was published in 1797, Thomas Hardy's *Tess of the D'Urbervilles*—a novel that replicates many of the plot-points of the former—tells an explicit story of a young girl raped, challenging the sexual morality of it's day. Most scholars have read Hardy's novel as a text concerned with rape and it's societal consequences. *Charlotte Temple*, however, does not have the same discourse surrounding it; *Charlotte Temple* is rarely read as a text about rape in the same way that *Tess of the D'Urbervilles* is. What allowed Hardy the ability to create a text that is centered on discussions of rape in a way that Rowson was unable to? How can a reading of *Tess of the D'Urbervilles* as such inform our perceptions of *Charlotte Temple* and our understanding of the societal discourse surrounding rape during and in-between Rowson's and Hardy's eras? By examining the societal discourse surrounding rape during the late 18th-century and the 19th century, I argue that both of these texts are fundamentally concerned with and part of the same extended conversation. By reading both texts together, we are better equipped to discuss *Charlotte Temple* as a text—by a female author—that was working through a conflict picked up one hundred years later. Such an understanding of *Charlotte Temple* re-contextualizes Rowson from an author simply participating in a genre tradition, into an author co-opting a genre so as to address as societal concern that was ahead of its time.

Edward Pomykaj is a second-year M.A. candidate in the English and Literature program at the University of Vermont. His research areas include philosophy and literature, 20th century American writers, queer theory, and psychoanalysis. His thesis project is focused on reconciling the legal perspectives of Hegel and Kafka, and their relationship as theorists to American literature and politics.

Dawn of #XSpoilers: Reading Hashtags as Digital Paratexts

Presenter: Adrienne Resha
Advisor: Arthur Knight
William & Mary,
American Studies

Comic book creators are active across social media, using platforms like Facebook, Tumblr, and Twitter to communicate with other industry professionals and fans. The letters columns that once graced the back pages of comic books have been all but replaced by those social media platforms, where interactions can happen in real time over the Internet. At no point in the last decade has that been more evident than it has in the lead up to Marvel's Dawn of X (DoX), a revival of their X-Men comic books. This paper explores the relationship between the weekly DoX prelude series House of X/ Powers of X (2019) by Jonathan Hickman, Pepe Larraz, and R.B. Silva and #HoXPoX and #XSpoilers tweets by readers, reading the latter as next generation, digital paratexts. These digital paratexts range from reactionary memes (often using screenshots of digital comic books) to anticipatory theories. All of these have been circulated on a social media platform, Twitter, that invites active and reactive participation from creators, readers, and readers-turned-creators through the use of hashtags. Through the letters column, comic books have long been participatory media, but their potential to be more (but never completely) democratic participatory media has been exponentially increased by the advent of digital technologies, especially social media. Subject not to editorial oversight, but to algorithms, comic book readers have more agency online than they have ever had in print.

Adrienne Resha is a third-year Ph.D. candidate in the American Studies Program at William & Mary. Her research interests include Arab and Muslim representation in American popular media, the superhero genre, and (new) media theory. She holds a B.A. (International Affairs and Anthropology) from Florida State University and an M.A. (Middle Eastern and South Asian Studies) from the University of Virginia.

"Let the Doctor Alone": Symbolic Lynching in Charles W. Chesnutt's *The Marrow of Tradition* (1901)

Presenter: Shaun F. Richards
Advisor: Susan Donaldson
William & Mary,
American Studies

The only successful political coup d'état on United States soil occurred on November 10, 1898 in Wilmington, North Carolina. A group of white supremacists murdered black men, women, and children; destroyed black businesses and property; and forcibly exiled elected officials and black middle-class professionals from the city. One of the major causes leading up to what has come to be known as the Wilmington Racial Massacre was an editorial published in a local black newspaper that denounced the practice of lynching. The plot's orchestrators used this article as a call to action for white men to commit atrocities against the city's majority black population. A few years later, Chesnutt novelized the action leading up to these events. His protagonist, Dr. William Miller, is a successful surgeon whose son is killed and whose hospital is destroyed as a result of the white riot. Part of a larger dissertation chapter on the impossible paradox posed by black medical professionalism within the white supremacist tradition of the Jim Crow South, this paper reads the racialized violence committed against Miller as a symbolic lynching intended to punish black advancement into the white public sphere. It contends that the near-lynching subplot of a minor character in the novel provides an important but critically underexplored interpretive key for understanding Chesnutt's reconfiguration of black masculinity at the turn of the twentieth century.

Shaun F. Richards is a Ph.D. candidate in the American Studies Program at William & Mary and a 2020-2021 Michael Halleran Dissertation Completion Fellow. His dissertation reads fictional doctors and scientists in U.S. literature between 1895 and 1935 as challenging the masculine gendering of scientific medicine. He holds an M.A. (English) from the University of Rochester and a B.A. (English) from the University at Buffalo, The State University of New York.

American Pragmatism in the Postmodern World: A.R. Ammons and Ecopoetry

Presenter: Seunghyun Shin
Advisor: Daniel Fogel
University of Vermont,
English

After ecocriticism, the study of literature that discusses environmental concerns and the ways it treats nature, established itself as a school of literary criticism in the 1990s, ecocritics have been arguing that postmodernism underappreciated the relationship between poetry and the reality it seeks to represent at a time of overwhelming environmental issues. This research contradicts such arguments through reading the works of a modern American poet, A.R. Ammons. The main goal is to illuminate Ammons' commitment to pragmatic poetry that aims at cultural shifts. In illuminating the pragmatic poetics in Ammons' poems, the research will counter the ecocritical assertions about the relationship between postmodern poetry and literary criticism by considering his poetry as a medium for revitalizing language and ideology. To make this argument, the research will first explore what American pragmatism is and how pragmatists such as Ralph Waldo Emerson and William James have influenced poets to establish ground for postmodern poetry. The research will then discuss how Ammons extends the pragmatic tradition in his poetry and how it ultimately provides a counterpoint to the ecocritical commentary on the relationship between postmodern poetry and postmodernist literary theory. In other words, the research analyzes Ammons' poems that revitalizes language and ideology through extending the pragmatic practice of writing poetry.

Seunghyun Shin is a first-year M.A. student in the Department of English at the University of Vermont. His research interests include 19th and 20th century Anglo-American literature, modernist poetry, and contemporary poetry. He is currently working on the thesis about modernist poet, William Carlos Williams. He holds a B.A. (English) from the University at Albany, The State University of New York.

Analysis of Activity Area Patterning at the CL-07 Site (Djibouti, Africa)

Presenter: Madeleine Gunter Bassett
Advisor: Martin Gallivan
William & Mary,
Anthropology

Recent (2019) archaeological surveys in southeastern Djibouti identified a multi-component shell midden site (CL-07). An analysis of the intra-site patterning of Surface Artifact Scatters (SASs) at CL-07 suggests that the site was a location of interaction and marine resource exploitation during multiple periods. As part of a larger study of pastoralist landscapes in eastern Djibouti, data form CL-07 have the potential to improve current understandings of coastal interaction networks in the Horn of Africa.

Madeleine Gunter Bassett is a Ph.D. candidate in the Anthropology Department at William & Mary and a 2020-2021 Michael Halleran Dissertation Completion Fellow. She is an archaeologist with active research projects in North America and Africa. Her dissertation -- "Revisited Landscapes: The Archaeology of Pastoral Mobility, Interaction, and Aggregation in Djibouti (ca. AD800-1600) -- uses archaeological data to consider how mobile herder-gatherers maintained social and economic networks during the Medieval Islamic Period (ca. AD1000-1400).

Discrimination, Cultural Heritage & Ethnic Identity Among Immigrants from Spanish-speaking Latin American Countries

Presenter: Laura Brugger
Advisor: Ness Sandoval
Saint Louis University,
Sociology and Anthropology

While meaningful relationships among cultural heritage maintenance, ethnic identity, and discrimination have been well-documented among cultural and ethnic minorities, many studies have been largely panethnic, and little has examined these relationships specifically among first-generation immigrants despite evidence that generational differences exist. This study examined the relationship of discrimination perceptions on reported cultural heritage maintenance specifically among first-generation immigrants from Spanish-speaking Latin American countries. Using secondary data from the 2012 Latino Immigrant National Election Survey (LINES), logistic regression was used to assess the relationship among discrimination perceptions and three measures of cultural heritage importance among first-generation immigrants from Spanish-speaking Latin American countries. It was found that perceptions of discrimination against the Hispanic population were associated with a higher likelihood of reporting Hispanic identity as important to one's sense of self. On the other hand, personal experiences with discrimination were associated with a lower likelihood of reporting Spanish language maintenance as important. These findings suggest that generational and contextual nuance exist within discrimination responses, and that discrimination impacts the first-generation population in unique ways, particularly regarding Spanish language maintenance. This is consequential because this variation in discrimination responses has implications for either inclusion or marginalization.

Laura Brugger is a Ph.D. student in the Public and Social Policy program within the Sociology and Anthropology Department at Saint Louis University. Her research focuses on discrimination, cultural heritage, and ethnic identity among immigrant and indigenous populations. She holds a M.A. degree in Sociology from Saint Louis University and B.A. degrees in Psychology and Spanish from the University of Nebraska-Lincoln.

Preliminary Explorations of Traditional Taro Farming in Rurutu, French Polynesia

Presenter: Claudia Escue
Advisor: Jennifer Kahn
William & Mary,
Anthropology

This project uses Geographic Information Systems (GIS) to develop data to test in a future ethnoarchaeological study of traditional taro farming in Rurutu, French Polynesia. Spatial data for over 900 taro fields in every major field system on the island were derived from aerial imagery. Using ArcGIS Pro, the stage of each field (ie. fallow, flooded, or growing) was characterized and the area of each field documented. In addition, perennial stream data was created from aerial imagery and a digital elevation model of the island. Computational analysis compared field area and slope for each individual field. Overall field productivity was modeled using a formula derived from previous ethnoarchaeological research in Polynesia to determined probable yearly yields. Comparisons between the windward and leeward field systems on Rurutu suggest differences in productive capacity linked to environmental conditions. Preliminary results permit the development of more informed questions for future ethnoarchaeolgical research such as: How does the aerial imagery data used in this project compare with Rurutu's taro fields at other points in history? What aspects of traditional taro farming are a result of biological constraints and which are a result of cultural practices? And how accurate is the productivity model in determining the production of field systems? Finally, this project fills an existing lacuna in our understanding of subsistence practices in Rurutu and the ongoing resiliency of small householder farming more broadly in Oceania and beyond.

Claudia Escue is a first-year M.A./Ph.D. candidate in the Anthropology Department at William & Mary with a focus on Archaeology. Her areas of interest include ethnoarchaeology, traditional farming methods, food culture, and traditional diets in Polynesia. Her current research is focused on Rurutu in the Austral Islands, French Polynesia.

What Civilizations do the Forests Conceal? Prospects of Laser Scanning in Surveying Archaeological Landscapes in Nigeria

Presenter: Tomos Llywelyn Evans
Advisor: Neil Norman
William & Mary,
Anthropology

Recent state-of-the-art Light Detection and Ranging (LiDAR) methods have revolutionised archaeology. Laser pulses are emitted that penetrate forest cover and construct high definition three-dimensional models of the forest floor's topography. This offers an invaluable glimpse of archaeological landscapes in densely forested regions normally obscured from aerial imagery. Ground-breaking studies of the archaeology of the Maya (Yucatan), Khmer Empire (Cambodia) and Amazonian civilisations (Brazil) have used LiDAR data to better understand the dynamics of past complex societies. They have typically asked questions aimed at understanding diverse systems of social and political organisation, specific structures of power and rulership, the nature of urbanism and urbanisation and how each of these phenomena physically manifest in the landscape. However, large gaps in our knowledge exist and certain questions remain unanswered. Firstly, there have not yet been any such LiDAR studies focussing on past societies in the West African forest belt. Secondly, while large, etic, top down models of social complexity have been explored, past studies have often failed to use LiDAR data to answer more emic questions about local religious belief and cosmology. This talk will thus focus on the prospects of upcoming LiDAR research in Nigeria organised by a team from William & Mary. It will explore how the method will work when approaching large-scale earthworks in Nigerian rainforest landscapes and investigate what the resulting data may tell us about the nature of past societies in this region.

Tomos Evans is a third-year Ph.D. student in the Anthropology Department at William & Mary. His research revolves around understanding the nature, organisation and ontologies of past societies in southwestern Nigeria and how these influenced their engagement with the landscape, with specific regard to monumental earthwork construction. He received his B.A. in Archaeology from the University of Cambridge and his M.A. in African Studies from University College London.

Establishing Provenance and Analysis of King Wak Chan K'awiil's Bowl

Presenter: Xavier Giovanni McClean
Co-Authors: T. Ardren, H. Ketunnen
Advisor: William Pestle
University of Miami,
Anthropology

Over a 60-year period, the Frost Museum of Science, Miami, Florida constructed a substantial collection of Pre-Columbian artifacts, of which one third relate to ancient Maya culture. These artifacts have an established date range from around 200 BCE-1300 CE. An assessment of the collection conducted in March 2014 documented around 400 separate objects with six ceramic vessels identified as strong contextual sources of information detailing strife within the city-state of Tikal. One of these six vessels is the focus of this followup analysis, and is tagged as the bowl of King Wak Chan K'awiil, a prominent Maya ruler of Tikal who dealt with various conflicts, dated to the early 6th century CE. The bowl is decorated with a statement of ownership associated with elite vessels known as the Primary Standard Sequence. This paper presents a study of this artifact that includes discussion of the artifact's entry into the Frost Museum collection, its epigraphic text, and its likely place of manufacture or use. It is essential to establish context within management of archaeological resources and this study provides an example of how to analyze objects that appear within miscellaneous and unprovenanced museum collections.

Xavier McClean is a second-year Master's Student at the University of Miami. He is seeking a degree in Applied Archaeology from the graduate school of Arts and Sciences. He currently holds a B.A. in Anthropology from the University of Arizona.

Genetic Perspectives on the Paternal Ancestry of Afro-Puerto Rican Communities

Presenter: Katie McCormack
Advisor: Jada Benn-Torres
Vanderbilt University,
Anthropology

The legacy of the Transatlantic Slave Trade is evident in the diverse identities and genetic ancestries found in the Caribbean today. Beginning in the 16th century, an estimated three million enslaved African people were forcibly relocated from western and central Africa to the Americas. Although a resulting admixture of African, European, and Native American peoples has been documented, the heterogeneity of modern Caribbean populations is not reflected in national histories that exclude marginalized communities. Our study aims to document these patterns of genetic ancestry in Afro-Puerto Rican communities. Previous research on the maternal ancestry of these communities found that 68% of individuals had maternally-inherited haplotypes of African origin; however, less is known about their paternal ancestry. To this end, we used Pyrosequencing to genotype diagnostic SNPs for Y Chromosome haplogroups in 28 Afro-Puerto Rican men. Because the Y Chromosome is uniparentally inherited through men to men, this technique provides insights into the patterns of paternal ancestry in the population. The vast majority of men had African paternal ancestry while a minority had Indigenous paternal ancestry, suggesting that both African and Indigenous Caribbean men were formative in shaping contemporary Afro-Puerto Rican communities. These findings also demonstrate a complex ancestry of Afro-Puerto Ricans that is distinct from that of the general Puerto Rican populace. Additional studies will provide a fuller understanding of the interactions between populations throughout Caribbean history.

Katie McCormack is a first-year Ph.D. student in the Anthropology department at Vanderbilt University. Her research focuses on using genetic methods to answer questions related to disease and the history of colonialism in the Caribbean. She holds a B.S. in Biology and Anthropology from William & Mary.

The Application of User Experience Research to Anthropology and Museum Spaces

Presenter: Alexandria Mead
Advisor: Danielle Moretti-Langholtz
William & Mary,
Anthropology

The field of User Experience (UX) has traditionally been applied to website design, app development, video-gaming, and other technologies—moving into the future, can we begin applying the field of UX to the humanities? My research focuses on the application of UX through a methodological review of traditional UX research and applies it to the field of anthropology and museum studies to answer: can we more effectively teach and engage the public in museums? My poster aims to present how I am currently applying UX to anthropology by highlighting current difficulties which museum specialists and archaeologists face when trying to engage members of the public in archaeological and museological forums. This research addresses an important topic currently present in the anthropology/ archaeology field: how to become more transparent and community based in our research.

Alexandria Mead, a first-year Ph.D. student in Anthropology at William & Mary, received her B.A. in Anthropology from the University of North Carolina in 2013, where she became interested in historical archaeology. She went on to receive her MA from the University College of London. Her studies at UCL focused on the intersection of public archaeology and museum studies and how the public engaged with archaeology in different contexts.

Rations and Recreation: Comparative Zooarchaeology at Betty's Hope Plantation and Shirley Heights Fort in Antigua, WI

Presenter: Alexis Ohman
Co-Authors: H. Zhang, D. Yang, C. Speller
Advisor: Jennifer Kahn
William & Mary,
Anthropology

The complexities of the colonial period across the Atlantic have been explored from myriad angles and disciplines. Historical zooarchaeology—the study of faunal material from archaeological sites—has investigated this time period via intersections between New World and Old World animals, environments, and foodways practices. Such research has revealed archaeological evidence of servants, soldiers, and enslaved Africans, whose daily lives were often neglected in historical documents. My research at Betty's Hope plantation and Shirley Heights fort in Antigua, West Indies, addresses an additional lacuna in the archival documents for both sites: the ways in which fish and mollusks were procured and utilized. The comparative research between these two sites has revealed significant distinctions in how these taxa were consumed along race- and class-based lines at both the plantation and fort site. Specimens from the herring family provide the opportunity for further research ventures because they may represent local tropical species or imported temperate species. A pilot study was designed with the University of British Columbia to extract ancient DNA from the herring bone to identify the species. The results of the study provide more concrete information on long- and short-distance provisioning networks throughout the Caribbean and North Atlantic.

Alexis Ohman is a Ph.D. candidate in the Anthropology Department at William & Mary. Her research uses zooarchaeological and archival evidence from Betty's Hope plantation and Shirley Heights fort in Antigua, West Indies, to explore how certain animals were differentially consumed on these sites along race- and class-based lines. She holds a B.A. (Anthropology) from the University of Victoria and an M.A. (Archaeology) from Simon Fraser University. All co-authors are affiliated with the Ancient DNA Laboratory in the Department of Archaeology at Simon Fraser University. She is the Chair of the 19th Graduate Research Symposium.

Keeping Time: Temporality, Memory and Distributed Personhood in a Concealed Assemblage from Bacon's Castle

Presenter: Rebekah Leslie Planto
Advisor: Audrey Horning
William & Mary,
Anthropology

The intentional concealment of shoes and other items within the walls of buildings, most commonly recorded in 19th-century contexts from Britain, Ireland, and the United States, has long been viewed as an apotropaic ritual. However, symbolic interpretations of a practice for which there is no contemporary testimony are inherently limited, mystifying rather than enhancing understandings of these objects and the people who engaged with them in the past. The unexpected discovery of concealed deposits among the archaeological collection from Bacon's Castle in Surry County, Virginia, affords a unique opportunity to investigate this practice in an unusually long-lived domestic structure in a region where such finds have seldom been reported. This paper analyzes these materials and proposes an alternative framework for interpretation of symbolic, or ritually produced deposits. Grounded in Peircean pragmatism, which considers things and relationships in terms of their effects in specific contexts, it also draws inspiration from assemblage theory, which similarly emphasizes contextual relations between and among entities, but goes further to explore how human qualities are distributed and experienced through interactions with non-human things across time and space. Recognizing the power and meaning of concealed deposits as expressions of the distributed human affect, relationships, and agency that produce and draw them together as assemblages both demystifies such contexts, and reveals something about our own relationships with objects we experience as symbolically meaningful.

Rebekah Planto is a second-year Ph.D. student in the Historical Archaeology program in the Department of Anthropology at William & Mary. Her research focuses on material negotiations of identity and lived experience in the early modern Atlantic world, particularly in plantation contexts. She is currently researching the site associated with Bacon's Castle in Surry County, Virginia.

Measurements of Graphene Interfacial Forces Using AFM Colloidal Probe Technique

Presenter: Avishi Shavindya Abeywickrama
Co-Author: W. Dickinson
Advisor: Hannes Schniepp
William & Mary,
Applied Science

Graphene has become one of the most important materials in the world over the past two decades due to its outstanding properties such as high electrical and thermal conductivity, strength and transparency. Though it has a wide variety of applications, the mass production of high-quality graphene in a cost-effective way is still a challenge. As a solution for this problem, we have found a simple, inexpensive and scalable method called 'Interface trapping method' to produce graphene using only pristine natural flake graphite and two immiscible solvents. In this method, we observed that graphene is exfoliated at the interface of these two solvents. To optimize and develop this method we need to know the phenomena behind this behavior of graphene. Therefore, we study the interactions between graphene and liquid-liquid interfaces using force spectroscopy technique, a mode of atomic force microscope (AFM) that is a powerful tool to study these interactions, featuring nanometer spatial and piconewton force resolutions. For the force measurements, we manufactured our own colloidal probes and coated them with graphene. In the experiments, we measured a long-range attractive force between graphene and the interface. Also, we studied the variation of these forces with respect to the reduction level of graphene. With these experimental results, we have determined the interactions between graphene and liquid-liquid interfaces. With the knowledge of these interactions, Interface trapping method will be developed to yield high-quality graphene at industrial scale.

Avishi Abeywickrama is a third-year Ph.D. candidate in the Applied Science Department at William & Mary . Her research areas include nanotechnology and materials science. She is currently studying the interactions of graphene. She holds a B.Sc. in Physics from University of Cololmbo, Sri Lanka.

Rhythmicity in a Neural Network Model Based on Recurrent Synaptic Excitation and Synaptic Depression

Presenter: Daniel Scott Borrus
Advisor: Christopher Del Negro
William & Mary,
Applied Science

Eupnea, or normal unlabored breathing, is a rhythmic behavior driven by a group of (600-1000) neurons, located in the preBötzinger Complex (preBötC) of the ventral medulla. These neurons generate periodic bursts of action potentials that propagate to motor circuits and thus drive the diaphragm and ventilate the lung. The contemporary hypothesis suggests recurrent synaptic excitation among excitatory neurons drives the upstroke of the neural activity (burst). The details of the recurrent excitation, as well as the cellular or synaptic mechanisms that terminate the burst, are still not fully understood. This project uses an original mathematical model to investigate the mechanisms for rhythmic preBötC activity. First, we show the network model can have rhythmic bursts, where recurrent excitation between neural units drives a burst upstroke, and synaptic depression terminates the burst. Next, we differentiate between two types of recurrent excitation that may lead to a burst: a cascading, monotonic buildup of network activity versus a neuron-to-neuron spike synchronization and signal resonation. Finally, we examine the contribution of network topology on rhythmicity.

Daniel Borrus is a third-year Ph.D. candidate in the Applied Science Department at William & Mary. His research employs a computational modeling and electrophysiology approach to understand the neural origins of breathing. His first project investigated the relationship between normal breathing and sighing. Now, he is working on a mathematical model to explain the neurological mechanisms that give rise to inspiratory breaths.

Global Shipping Container Monitoring Using Machine Learning with Multi-Sensor Hubs and Catadioptric Imaging

Presenter: Ethan Brewer
Co-Author: V. Trujillo
Advisor: Mark Hinders
William & Mary,
Applied Science

This research describes a framework for global shipping container monitoring using machine learning with low-power sensor hubs and infrared catadioptric imaging. A mesh radio satellite tag architecture provides connectivity anywhere in the world, with or without supporting infrastructure. A low-cost, long-wave infrared catadioptric imaging device and multi-sensor hub combination, when equipped with physics-based machine learning algorithms, can automatically interpret the scene inside a shipping container. Ultrasonic Lamb waves are then used to transmit that information through the steel wall of the shipping container. We discuss the phenomenon of guided elastic waves and their propagation in a corrugated steel plate. Experimental data in the form of transmitted and received ultrasound vibrations were collected from a sample of steel shipping container. Automatic wave mode classification using the dynamic wavelet fingerprint and machine learning is presented for the purpose of encoding information through-metal in a sound signal.

Ethan Brewer is a second-year Ph.D. candidate in the Applied Science Department at William & Mary. His research areas include the application of physics, particularly Mie scattering theory, and machine learning. He is currently conducting research in healthcare monitoring and analytics for Philips. Ethan holds a B.S. in Physics from the University of Maryland, Baltimore County (UMBC) and served six years as an officer in the U.S. Navy.

Using Machine Learning to Predict Non Permissive Environments in Nigeria

Presenter: Seth Goodman
Co-Author: A. BenYishay
Advisor: Daniel Runfola
William & Mary,
Applied Science

Machine learning applications have a growing role in the monitoring and evaluation of international development. Recent work has shown the utility of combining widely available satellite imagery with convolutional neural networks (CNNs) to produce estimates of sparse data such as poverty rates at relatively granular levels. This paper will explore the expansion of CNN based methods to predict the likelihood of conflict in Nigeria, incorporating multi-spectral Landsat 8 imagery and pre-trained convolutional neural networks. The Armed Conflict Location and Event Data (ACLED) dataset will be used for fine-tuning and validation of the training of the CNNs over a range of hyperparameters and sampling schemes. Indicators of future conflict in developing countries have the potential to be a valuable resource for decision makers sending personnel and resources to conflict prone regions.

Seth Goodman is a third-year Ph.D. candidate in the Applied Science Department at William & Mary. His research currently focuses on machine learning applications that utilize satellite imagery and survey data to predict indicators of poverty and conflict. Other applications of Seth's work include publicly available tools which implement novel geospatial data processing methods to efficiently process data for thousands of researchers and organizations around the world.

Successive Photonic Ablation as an *in Vitro* Model of Neurodegenerative Disorders

Presenter: Cameron J. Grover
Advisor: Christopher Del Negro
William & Mary,
Applied Science

Neurodegenerative disorders are often attributable to neuronal loss. An in vitro experimental paradigm that models neurodegeneration can lead to a better understanding of pathology and provide insight into potential treatment. This project presents such a method that utilizes laser scanning two-photon microscopy to automatically detect neurons of a specified population via expression of a genetically encoded indicator, then photonically ablate these neurons in a sequential and cell-specific manner while simultaneously monitoring an observable output. This method provides a measure of precisely how much cell loss would result in a breakdown of network function, i.e. an in vitro model of neurodegeneration. Here, we use a genetically encoded calcium indicator (GCaMP6f) to identify and ablate rhythmically active respiratory neurons that generate the breathing rhythm. This method can be applied to any neural network that controls an observable output or behavior, provided the network's loss of function is the basis of a neurodegenerative disease.

Cameron Grover is a third-year Ph.D. candidate in the Applied Science Department at William & Mary. His research aims to uncover the cellular mechanism responsible for generating the breathing rhythm. He holds a B.S. (Biomedical Engineering) and M.S. (Applied Physics) from Virginia Commonwealth University.

Advanced Time Series Analysis to Discover Bot Driven Topics on Twitter

Presenter: Spencer Lee Kirn
Advisor: Mark Hinders
William & Mary,
Applied Science

Fake news is on the forefront of modern political discourse. Covert actors commonly employ fake news in order to push a narrative or accomplish some goal. For example, in 2016 Russia launched a systematic fake news campaign to sow discord in the U.S. voter base and influence the Presidential election. Content moderation at scale is an intractable problem in a free society, and fake news is extremely difficult to identify by analyzing the content of posted media because the covert actors are careful to ensure their content mimics traditional news stories. However, characteristics of their propagation through social media can be exploited to identify fake news. Networks of automated bots disguised as human users interact with each other in order to push fake news towards the targeted audience. Utilizing Natural Language Processing techniques we can isolate topics within social media beyond what is trending, analysis of a topic's volume over time exposes how that topic propagates through and across social media platforms. Networks of human users discussing some topic should exhibit behavior that is characteristically different than networks of automated users, though this behavior is usually buried deeply in noise, especially as more humans are drawn to the conversation. In this presentation we report on our work to adapt time series analysis techniques developed to extract information from noisy lamb wave signals in Nondestructive Evaluation paired with machine learning in order to identify topics that are disproportionately driven by bot accounts.

Spencer Kirn is a fourth-year Ph.D. candidate in the Applied Science Department at William & Mary. His research interests include applications of machine learning and signal processing to solving a wide array of real world problems. He currently holds a B.A. in physics from the College of Wooster and an M.S. in applied science from William & Mary.

The Antipsychotic Potential of Orexin Receptor Inhibitors for the Treatment of Schizophrenia

Presenter: Eden Blake-Lea Maness
Advisor: Joshua Burk
William & Mary,
Applied Science

Schizophrenia (SZ) is a psychiatric condition encompassing two distinct symptomatologies: positive symptoms, such as hallucinations and delusions, and negative symptoms, including motivational and cognitive deficits. Although current antipsychotics, which reduce dopamine overactivity in the brain, are able to provide relief for sensory disturbances, they either fail to alleviate or exacerbate impairments of motivation, attention, learning, and memory. Because the severity of negative symptoms more accurately predicts functional and clinical outcomes, there is a substantial need for medications that more holistically treat this debilitating illness. The lateral hypothalamic orexinergic system acts as a gatekeeper of several neurotransmitter networks involved in not only homeostatic regulation, but motivational activation and cognition as well, and in recent years has gained interest as a novel pharmacotherapeutic target for SZ. A recent experiment from our lab offers additional support, as blocking orexin neurons was able to reduce sustained attentional impairments and response deficits in a commonly-employed rat model of SZ. As such, the medicinal potential and clinical application of orexin receptor inhibitors for the treatment of SZ will be discussed, with particular focus on attentional and motivational restoration.

Eden Maness is a third-year Ph.D. candidate pursuing her doctorate in neuroscience through the Applied Science Department at William & Mary. Her research explores the underlying neurobiology of attentional processing and performance through a clinical lens. In particular, her dissertation endeavors to parse the potential of various experimental compounds to restore attentional function in rodent models of psychosis.

Analysis of Spatiotemporal Pattern of Calcium Spikes in the Neural Plate of *Xenopus laevis*

Presenter: Sudip Paudel
Co-Authors: R. Nalamalapu, A. Rahman, E. Li, P. Kemper
Advisor: Margaret Saha
William & Mary,
Applied Science

High-throughput spatiotemporal measurements of cellular attributes *in vivo*, such as calcium (Ca^{2+}) activity at the single-cell level, are essential for understanding of the underlying dynamics of embryonic development. However, it is a challenge to obtain these measurements from a tissue type such as early neural tissue, where cells are undergoing ongoing division, intercalation, and migration. Moreover, Ca^{2+} activity is multidimensional; it occurs in many different forms including spikes and waves and at different amplitudes, frequencies, and locations, parameters that are important for neural development. However, unlike Ca^{2+} spikes of mature neurons, spatiotemporal patterns of the seemingly stochastic spiking that occurs in the developing vertebrate nervous system remain poorly understood. It remains unknown whether there is a stereotypical spiking pattern in embryos at a given stage of development or whether the activity is truly stochastic. This is largely due to the lack of an appropriate and comprehensive analysis technique. In this study, we aim to analyze spatiotemporal pattern of spikes of presynaptic neurons in the neural plate of *Xenopus laevis*. Our preliminary analysis of the *Xenopus* neural plate using a genetically encoded Ca^{2+} marker (GCaMP6) suggest that while Ca^{2+} waves occur in a conserved pattern, spiking activity appears to be stochastic. Our approach of digitally creating a composite neural plate from many embryos, in general, can be applied to conduct spatiotemporal analyses of various cellular attributes that require imaging disparate tissue regions.

Sudip Paudel is a fifth-year Ph.D. candidate in the Applied Science Department at William & Mary. His research area includes understanding underlying molecular mechanism(s) of early neural development. The development of central nervous system is orchestrated by a complex network of transcription factors and signaling molecules, including calcium. For his Ph.D. dissertation, he is studying spatiotemporal pattern of calcium spikes during early neural development.

Characterization and Modeling of the Mechanical Anisotropy of Recluse Silk

Presenter: Dinidu Prabhath Nissank Perera
Co-Author: Q. Wang
Advisor: Hannes Schniepp
William & Mary,
Applied Science

Spider silk is a biopolymer with a remarkable combination of strength and extensibility. Its tensile strength is comparable to high strength steel and it can absorb 5x more energy than Kevlar before it breaks. Hence it has many potential applications in various fields. Since spiders do not produce enough silk, production of synthetic spider silks has recently drawn significant attention. Complete and accurate knowledge on the structure and properties of natural spider silk is essential to produce comparable synthetic silks. One such important aspect is the knowledge on silk's anisotropic mechanical properties such as transverse stiffness and transverse breaking strength (mechanical properties perpendicular to the fiber axis). The complex structure and micro-scale diameter of cylindrical silks make it extremely difficult to characterize these properties. However, the silk of recluse spiders has a much simpler structure and flat ribbon-like morphology. Also, its mechanical properties are comparable to the best cylindrical spider silks. We use a specially tailored experimental setup by suspending a recluse silk ribbon over a 2 micrometer diameter hole and use an atomic force microscope to indent the suspended region at different positions to find the required forces. Then, we combine the experiments with computer simulations (finite element analysis) to characterize the anisotropic mechanical properties of recluse silk. For the first time, we measured the transverse stiffness of recluse silk as 2 GPa, which is 1/9th of its tensile modulus.

Dinidu Perera is a third-year Ph.D. candidate in the Applied Science Department at William & Mary. His research areas include spider silk and metamaterials. He is currently working on characterizing the structure and properties of recluse silk by combining specially tailored experiments with computer simulations.

Classification of Data and Control Packets in Wireless Communications Networks

Presenter: Margaret Rooney
Advisor: Mark Hinders
William & Mary,
Applied Science

The control plane of a communications network relays information about the topology of nodes, routing paths of data, and the availability of frequency bands. The ability to identify control information can be useful in the development of cognitive radio networks where nodes can intelligently alter transmission parameters in order to optimize use of the electromagnetic spectrum. Knowledge of control information provides valuable insight into the behaviors of existing networks, enabling cognitive radios to integrate themselves into communication channels without causing interference to other users. In this work we present a method of distinguishing between data and control packets in 802.11ac wireless networks. The data used to develop our classifier is composed of signals collected in a range of indoor and outdoor locations, allowing our algorithm to be trained on inputs that reflect the intricate interactions between electromagnetic waves and the environment. We employ a series of time-frequency and time-scale transformations to convert the collected spread-spectrum radio frequency signals into higher dimensional binary images which form the basis for our machine learning feature vectors. We extract features from fingerprint-like objects in the binary images using image processing techniques, after which we perform statistical tests to aid in downselection. This allows us to optimize the composition of the feature vectors and avoid the curse of dimensionality. We evaluate the effectiveness of our feature vectors by comparing results from several classification algorithms.

Margaret Rooney is a fourth-year Ph.D. candidate in the Applied Science Department at William & Mary. Her dissertation research focuses using machine learning to determine various features of wireless communication networks, and characterizing the interaction of high frequency radio waves with the environment. She holds a B.S. in Mathematics from St. John's University and an M.S. in Applied Science from William & Mary.

Nonlinear Three Dimensional Simulations of Length Limited Parametric Arrays for SonicNets

Presenter: Elizabeth Drummond Skinner
Co-Authors: M. Rooney, S. Kirn, E. Brewer
Advisor: Mark Hinders
William & Mary,
Applied Science

Birds cause billions of dollars worth of damage annually in aerospace and agricultural industries worldwide. Traditional bird deterrents are expensive, lethal, or short term solutions. We have been developing SonicNets, a benign acoustic deterrent that uses a colored noise signal to interfere with the audible communication of pest birds. We create a localized area where acoustic communication is difficult, causing the birds to leave. Traditional speakers are often used to cover large areas with SonicNets, but in urban and suburban environments we employ parametric arrays to control the sound. Parametric arrays are highly directional speakers that create audible sound beams using the nonlinearity of air. One speaker plays two ultrasound frequencies, and the nonlinear interaction in the air creates a difference frequency. The difference frequency continues to propagate in the beam pattern of the ultrasound waves. Using these speakers we can direct the sound, but reflections off hard surfaces limits the possible applications for the technology. We have been studying the The length limited parametric array (LLPA) which allows us to stop the sound after it has propagated a certain distance. To create an LLPA, we use two parametric arrays positioned next to each other to play two audible signals out of phase. We have shown that the LLPA is a real phenomenon in the laboratory, and are modeling this phenomenon using 3D finite difference time domain supercomputer simulations. These simulations provide insight into how the ultrasound and acoustic waves interact to create the LLPA.

Elizabeth Skinner is a Ph.D. candidate in the Applied Science Department at William & Mary in the Nondestructive Evaluation Lab. She is also the Lead Scientist at Midstream Technology. Her research interests include supercomputer simulations, acoustics, and image processing.

Bioinspired Toughness Enhancing Architectures for Thin Films and Fibers

Presenter: Ben Skopic
Advisor: Hannes Schniepp
William & Mary,
Applied Science

The spider *loxosceles laeta* spins its unique ribbon silk into a series of loops that have been shown to significantly increase the toughness of the silk. The series of loops is a one-dimensional mechanical metamaterial that we have studied to gain bioinspiration for more sophisticated architectures. We developed a model to predict the force required to cause the loop to fail as a function of the contact geometry and showed experimentally that our model is accurate. We discovered a critical transition angle between the less strong peeling mode and the stronger lap shear joint failure modes. The natural Loxosceles loop junctions are formed using a specific contact geometry that is above the critical angle which means that the loops fail in lap shear mode. The geometry of the loop junctions can be applied to thin film and fibrous materials at all length scales to increase toughness, allowing engineers to tune the toughness of such systems.

Ben Skopic is a first-year Ph.D. student in the Applied Science Department at William & Mary. His research group works with nanomaterials such as graphene, boron nitrite nanotubes, and silk. Ben's research focuses on determining the structure of spider silk and designing spider silk based structures for structural and adhesive applications.

Three Decades of Chesapeake Bay Water Clarity from Satellite Remote Sensing

Presenter: Jessie Turner
Co-Author: M. Friedrichs
Advisor: Carl Friedrichs
Virginia Institute of Marine Science,
Physical Sciences

The Chesapeake Bay is the largest estuary in the U.S. with the highest land-to-water ratio of any estuarine watershed in the world. Management policies actively limit watershed inputs of nutrients and sediments to the estuary. In this heavily-populated, highly-managed system, it is imperative to understand water clarity change over time. Spatially, this estuary has been examined with cruise-based observations, coarse spatial resolution satellite data, and 3D models, yet it lacks examination at finer spatial resolutions. Temporally, a gap exists in traditional ocean color satellite missions between 1986-1997. This study aims to fill spatial and temporal gaps using Landsat heritage missions, three decades of 30-m resolution imagery that can be used to monitor water clarity change over time. Although primarily designed to study bright land surfaces rather than dark water surfaces, aquatic applications are practical in turbid waters that contain more light-reflecting materials. Remote sensing reflectance of the red colored band (Rrs660), highly correlated to water turbidity, was analyzed from the Landsat 5 Thematic Mapper, Landsat 7 Enhanced Thematic Mapper, and Landsat 8 Operational Land Imager instruments. Rrs660 variability was evaluated using monthly composites from 1984-2019. Preliminary results suggest that Chesapeake Bay waters are sufficiently turbid to allow Landsat instruments to provide robust information regarding long term trends in water clarity throughout the Bay, and reveal variability on both seasonal and interannual time scales.

Jessie Turner is a Ph.D. candidate at the Virginia Institute of Marine Science, at William & Mary's School of Marine Science. She studies water clarity at local and regional scales, including observations, 3D numerical modeling, and satellite remote sensing. She holds a B.S. from Bowdoin College in Earth & Oceanographic Science and an M.S. from the University of Alaska Fairbanks in Oceanography.

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Using Acoustic Signals to Reduce the Incidence of Avian Collisions with Human-Made Structures in Open Air-Space

Presenter: Timothy Boycott
Co-Author: S. Mullis
Advisor: John Swaddle
William & Mary,
Biology

Billions of birds fatally collide with human-made structures each year and this source of mortality is a significant threat to bird populations. Collisions also pose serious challenges for human industries. Efforts to reduce collisions have largely centered on making structures more visible to birds but have been met with limited success. Solutions addressing the environmental context of hazards and the behavioral ecology of at-risk birds offer more tangible results. Birds have largely evolved without tall human-made structures in their flight path. Consequently, avian perception and behavior may not be suitably primed to detect these evolutionarily novel hazards. Work in captive settings has shown that conspicuous acoustic signals may aid in drawing attention of flying birds to collision hazards. We aim to corroborate these findings in a field setting by projecting acoustic signals into air space surrounding communication towers and quantifying differential movement patterns of flying birds between treatment and control trials as indicators of collision avoidance behavior. We also aim to identify which elements of acoustic signals elicit more collision-avoidance behavior in flying birds. Tests of differing types of acoustic signals in our field trials will allow for comparisons of the efficacy of signal types. Findings from these studies will inform the field of avian sensory ecology and assess the use of acoustic signals in collision mitigation measures.

Timothy Boycott is a second-year M.S. candidate in the Biology Department at William & Mary. He has a broad interest in studying animal behavioral ecology in a contemporary context, as a way of addressing some of the pressing conservation concerns of today. His current research focuses on using understandings of avian sensory biology to reduce the incidence of collisions between birds and human-made structures.

Changes in Study Methods, Problem-Solving, and Motivation After Instruction in Sketching in an Introductory Biology Course

Presenter: Jessica R. Burns
Advisor: Paul Heideman
William & Mary,
Biology

Model building can use drawing or sketching (D/S) as a mechanism to help the drawer learn information (study), solve problems (model-based reasoning, MBR), and communicate. Unfortunately, many students fail to master D/S skills due to the effort and instruction required. We applied guided practice of D/S to an undergraduate first-semester Introductory Biology majors course, aiming to assess (1) how much students continue to use D/S as a study tool in subsequent semesters, (2) the extent of D/S usage for MBR, (3) whether the use of D/S was correlated with correct answers on exams, and (4) student motivation towards sketching to learn. Students decreased their use of passive study methods during the course (pre: 56% to post: 37%; $P < 0.01$). Major changes included less visual review (from 38% to 25% of study time; $P < 0.01$) in studying and more D/S (pre: 13% to post: 42%; $P < 0.01$). In the pre-survey, only 5% of students listed D/S as part of their 'most effective' study method, rising to 33% in the post-survey ($P < 0.01$). Students who reported reluctance to change their study methods used less D/S while studying than those willing to change their study methods. These outcomes will be reassessed yearly. Our preliminary conclusion is that a course in this format can support development of D/S for MBR while developing more active study methods.

Jessica Burns is a second-year M.S. candidate in the Biology Department at William & Mary. Her research focuses on the use of drawing in undergraduate biology as a tool for studying and problem-solving with a focus on student motivation. She holds a B.S. in Biology from East Stroudsburg University in Pennsylvania with a concentration in Organismal Biology and a minor in Chemistry.

Endangered Species Act: Quantifying Threats Affecting Species

Presenter: Delaney Costante
Co-Author: A. Haines
Advisor: Matthias Leu
William & Mary,
Biology

The earth is currently in the midst of the sixth mass extinction; unlike the previous five, humans are the driving factor behind species' losses. In the U.S., the primary means of mitigating biodiversity loss is the Endangered Species Act (ESA); its purpose is to protect and recover imperiled species and the ecosystems upon which they depend. The aim of this project is to identify temporal trends and taxonomic differences in the threats which may impact imperiled species at the time of their listing. We developed a database of threats using the Federal Register final rule listing documents of every U.S. species (n = 1560) protected by the ESA between 1975-2019. Using this database, we identified 114 threat categories grouped into six broad categories: habitat modification, overutilization, pollution, species-species interactions, environmental stochasticity, and demographic stochasticity. Based on our previous work, we hypothesize that threats relating to habitat modification, interactions with invasive species (species-species interactions), and random environmental events (environmental stochasticity) will be the most prevalent across all taxonomic groups. We also hypothesize that the number of threats impacting species at the time of their listing will increase over time. This research will allow conservation practitioners to evaluate the effectiveness of conservation strategies. In addition, our research will provide crucial information to demonstrate how the recent changes to the ESA may be detrimental to the purpose of the ESA.

Delaney Costante is a first-year M.S. student in the Biology Department at William & Mary. She graduated from Millersville University with a B.S. in biology, including concentrations in marine biology, environmental biology, and animal behavior. She is currently working in the lab of Dr. Leu to identify temporal and taxonomic trends among the threats which impact imperiled species.

Identifying Loss-of-Function Mutants That Confer Resistance to Antidepressants in *Saccharomyces Cerevisiae*

Presenter: Paul A. Elizalde
Co-Author: J. Ou
Advisor: John Choy
The Catholic University of America,
Biology

Serotonin transporters are the primary targets of one of the most highly prescribed classes of antidepressants, the selective serotonin reuptake inhibitors (SSRIs). Yet, it is unknown what additional biological pathways and targets SSRIs might have. There have been several studies of antidepressants in the budding yeast, *S. cerevisiae* investigating possible "off-target" effects of SSRIs. Budding yeast is an ideal organism for "off-target" effects since they lack serotonin transporters. We sought to screen for mutations that confer resistance. Isolating resistant mutants has the potential to identify direct drug targets or activities required for drug toxicity. In this work, we screened a yeast library comprised of 4,577 gene deletions for deletions resistant to fluoxetine, also known as Prozac. We confirmed 48 gene deletions conferred some degree of resistance. We remade the 18 most resistant deletions and observed that 10 of them displayed resistance to fluoxetine, suggesting that the majority of the 48 deletions are true positives. In addition to genes that function in vacuolar-ATPase activity, which were previously implicated, we found several genes with functions in protein homeostasis (e.g. protein degradation and synthesis). We are trying to understand how changes in protein homeostasis confer resistance to SSRIs. Considering that antidepressants are orally taken, homologous microbial targets might lead to changes in gut microbial activity and/or composition, that may play an important role in antidepressant efficacy.

Paul Elizalde is a first-year M.S. student in the Department of Biology at The Catholic University of America. He is interested in exploring the effects of non-antimicrobial drugs on the gut microbiome. His research focuses on the identification pathways and activities affected by exposure to antidepressants in yeast and bacteria.

The Effect of Lighting Conditions on the Likelihood of Bird-Window Collisions

Presenter: Lauren Emerson
Co-Authors: T. Boycott, R. Thady
Advisor: John Swaddle
William & Mary,
Biology

Bird populations have declined substantially in the last 50 years as a result of human-induced change. Urbanization has introduced disturbances and novel structures to which birds are not well adapted. These evolutionary novel structures have caused an increase in fatal collisions and more specifically, fatal window collisions. Window collisions are one of the most significant sources of avian mortality and pose a large conservation risk to most species. Previous studies have proposed that UV- absorbing and reflecting window films are effective at reducing collisions, but these studies have not considered the proper lighting conditions that a bird would experience as it flies towards a window. Lighting conditions may impact the way a bird perceives a window, as these conditions may cause a window to appear as a reflection or extension of the surrounding habitat, impacting the efficacy of collision mitigation products. I am interested in determining which lighting conditions make a bird more susceptible to window collisions and whether lighting conditions impact the efficacy of collision mitigation products. I will study this by releasing birds one-by-one into a flight tunnel where they are forced to make a choice between two windows with various lighting conditions and treatments. I predict that if a mitigation product is highly detectable by a bird in a variety of lighting conditions, there should be no impact of lighting conditions on collision risk. It is essential that we take the steps to understand why collisions happen and reduce these vast declines.

Lauren Emerson is a first-year M.S. student in the Biology Department at William & Mary. Her research interests include ornithology, behavioral ecology and conservation biology. She is currently investigating how the lighting conditions surrounding a window impact the likelihood of bird-window collisions. She holds a B.S. in Integrative Biology from the University of Illinois at Urbana-Champaign.

Enhancing Coastal Resiliency Through Integrating People and Ecosystems: A Tale About Living Shorelines

Presenter: Amanda Grace Guthrie
Co-Authors: C. Hershner, S. Stafford
Advisor: Donna Bilkovic
Virginia Institute of Marine Science,
Biological Sciences

Coastal communities have interrelationships between social and ecological systems. Living shorelines cultivate co-benefits for society and ecosystems by utilizing nature-based features that provide shore protection while maintaining natural processes. Living shorelines often include created or restored salt marshes and can support aquatic communities. Yet, the extent that living shorelines mimic natural marshes has not been thoroughly investigated. We assessed nekton community composition, and Mummichog (*Fundulus heteroclitus*) condition, diet, and prey availability at 13 paired living shoreline and natural marsh sites in the Chesapeake Bay. Fish condition was similar among natural mashes and living shorelines indicating ecological drivers are comparable. Therefore, living shorelines support ecosystems, but living shoreline implementation remains low in Virginia. Increasing the use of living shorelines – instead of detrimental shoreline armoring (seawalls) – requires convincing property owners to make that decision. Through surveys, we determined how property owner decision making is influenced by their perceptions, modification costs, advice, and their interest in restoring shorelines. Contractors often play a large role in the shoreline modification process and may be a key factor in emphasizing living shoreline co-benefits to the ecosystem and property owner and society. By understanding the social drivers and ecological implications of living shorelines, we can conceptualize how feedback influences the system and how future changes may alter coastal resiliency.

Amanda Guthrie is a third-year Ph.D. student at the Virginia Institute of Marine Science, researching the intersection of people and ecosystems. Coastlines are some of the most altered ecosystems yet societies depend on coastlines for protection and many other benefits. Specifically, she researches "living shorelines" which are created, nature-based features (e.g. planted marshes) used for erosion control; she seeks solutions that benefit both society and natural systems.

Characterizing the Structure and Function of the Pseudophosphatase MK-STYX

Presenter: Emma Hepworth
Advisor: Shantá D. Hinton
William & Mary,
Biology

The pseudophosphatase MK-STYX [MAPK (mitogen-activated protein kinase) -phosphoserine/ threonine/tyrosine-binding protein] is a catalytically inactive member of the MKP (MAP kinase phosphatase) family. MK-STYX has an inactive DSP (dual-specificity) domain at the C-terminus that lacks critical histidine and cysteine residues in its active site motif (HCX5R). Despite lacking catalytic activity, pseudophosphatases maintain their fold and so maintain their ability to bind phosphorylated residues. MK-STYX is a regulator of various pathways such as apoptosis, stress response, and neurite formation. A missense mutation (P 311 A) in MK-STYX is implicated in intellectual disability and epilepsy. MK-STYX is known to induce these particular phenotypes, but its molecular mechanisms remain poorly understood. Therefore, it is imperative to obtain and understand the structure of MK-STYX. To address this, X-ray crystallography will be used to determine the macromolecular structure of MK-STYX. MK-STYX and its various forms will be cloned into a pET vector containing a polyhistidine tag (His-tag) and expressed in *E. coli* cells. The protein will be affinity purified with nickel beads, which have a high affinity for the His-tag. Purified protein will be used to generate a protein crystal for X-ray crystallography. The macromolecular structure of MK-STYX will provide insight into the mechanisms it utilizes to have a biologic effect. The structure of MK-STYX will be compared to its active MKP homologs, which will aide future studies to determine the exact role of MK-STYX in disease pathways.

Emma Marie Wilber Hepworth is a first-year M.S. student in the Biology Department at William & Mary. She holds a B.S. in Biology with a minor in Marine Science from William & Mary. Her research interests include protein biochemistry, signal transduction pathways, and how pseudophosphatases regulate these pathways.

A Falling Monarchy: Do Insecticides Hinder Flight Capabilities of the Monarch Butterfly?

Presenter: Amy E. Hughes
Co-Authors: J. Crall, C. Switzer
Advisor: Joshua Puzey
William & Mary,
Biology

In the midst of what some are calling an “insect apocalypse,” we search for explanations to this rapid decline in global insect populations. Chemical insecticides, utilized and intensified over the past seventy years to bolster crop production and feed a growing human population, are likely one of the main culprits. To explore the effects of neonicotinoids (hereafter neonics), the most widely used class of chemical insecticides, on pollinating insects, we will use the monarch butterfly as a model species. Half of our lab-reared butterflies will consume nectar containing neonics and the other half untreated, control nectar. To monitor and compare flight activity and feeding frequency between the two treatments, we will use free-flight cages equipped with video cameras. To analyze the effects of neonics on flight capabilities, we will use flight mills that test individual butterfly flight duration, distance, and frequency. The implications for this study are wide-ranging, pertaining to the function and persistence of insects, pollinators, and migratory species that inhabit areas in and around agricultural lands of the United States.

Amy Hughes is a first-year M.S. student in the Biology Department at William & Mary. She is generally interested in human impacts on ecological processes, and she is drawn to broad-scale ecological research with wide-ranging applications. She currently studies the effects of agricultural insecticides (neonicotinoids) on monarch butterfly flight capabilities, as "neonic" presence throughout North America may negatively affect monarch migration and thus survival and persistence of the species.

Following the Frogs: The Migration and Adult Habitat Use of Virginian Frogs and Toads

Presenter: Matthew Sinnwell Kane
Advisor: Matthias Leu
William & Mary,
Biology

Frog and toad species are currently facing a drastic global decline. One of the major causes of this decline, especially in North America, has been the destruction of habitat due to land development and pollution. Conservation strategies have focused on managing breeding habitat without regard to habitat needs outside of the breeding season. However, for most species, the breeding season is relatively short compared to the non-breeding season, and the migration of adults in the non-breeding season is understudied. Therefore, in order to create effective conservation strategies for frog and toad species, we must study the habitat use of adult frogs and toads during the non-breeding season. We utilized a relatively novel technique, harmonic direction finding, to track individual American toads (*Anaxyrus americanus*), Fowler's toads (*Anaxyrus fowleri*), and Pickerel frogs (*Lithobates palustris*) between breeding and wintering sites. We also utilized line transects at the same sites to examine the distribution and diversity of frog and toad species. Preliminary results indicate that individuals move up to 200m from their breeding site during the winter season. This demonstrates the potential importance of large tracts of forest around frog and toad breeding sites. By tracking individual frogs and toads and surveying their population, we will gain a more thorough understanding of frog and toad movement patterns and habitat use in Virginia. With this understanding, we will be able to make recommendations that will improve conservation efforts for frog and toad species.

Matthew Kane is a first-year M.S. student in the Biology Department at William & Mary whose research interests include ecology and animal behavior. He is currently studying the adult migration cycle of Virginian frogs and toads. In doing so, Matthew will determine the habitat requirements of frogs and toads throughout the nonbreeding season and provide essential information to future conservation efforts.

Investigating the Interaction Between Noise Pollution and Behavioral Traits in Eastern Bluebirds

Presenter: Heather Violet Kenny
Co-Authors: S. Weber, A. Kashmanian
Advisor: Dan Cristol
William & Mary,
Biology

Noise pollution from human activities such as vehicle traffic is becoming increasingly common and is known to impact wildlife species near sources of noise. Animals such as songbirds that rely heavily on vocal communication can be disturbed by noise because it masks vocal signals between individuals and makes it harder to hear approaching predators. Some songbird species are able to coexist with human disturbance, but it is likely that certain individuals in the population are better suited to noisy environments than others. Individuals vary in their expression of behavioral traits, and the behaviors of an individual are sometimes grouped into defined bold and shy “personality types”. This study investigates whether wild eastern bluebirds (*Sialia sialis*) exhibit strong personality types, and whether individuals with certain behaviors tend to sort into noisy and quiet locations. Our preliminary results show that the traits of aggression and neophobia (fear of a novel object) are not correlated within bluebird individuals, and these birds cannot be classified as bold or shy across these two traits combined. We also found a trend for more neophobic birds to occur at louder nest boxes. Further research will help determine whether neophobic birds prefer noisy sites, or whether they are being excluded from the more preferred quiet sites and thus end up in the noisier sites. This is important to investigate because if populations in noisy areas become dominated by neophobic birds, it could lead to emergent effects on population and community level processes.

Heather Kenny is a second-year M.S. candidate in the Biology Department at William & Mary. She is interested in animal behavior, and her research focuses on the ecological importance of animal personality and individual variation. Her thesis project investigates the behavioral responses of bold and shy eastern bluebirds to noise pollution.

Red Disease of American Eels in Chesapeake Bay: What We Do and Don't Know So Far

Presenter: Amanpreet Kohli
Co-Author: W. Vogelbein
Advisor: Andrew Wargo
Virginia Institute of Marine Science,
Aquatic Health Sciences

Stock assessments of American eels (*Anguilla rostrata*), a commercially, recreationally, and ecologically important finfish in the Chesapeake Bay, indicate their wild population is declining. Infectious diseases have been implicated as a cause in this decline. Animals held for sale are also affected by disease with eel fishers and distributors from the region reporting up to 20% disease-associated mortality. An infectious disease prevalent in the holding facilities, and patchily distributed in the wild, is the "red" disease which is characterized by severe skin ulceration. Our preliminary results, from standard bacteriological methods and 16s rRNA sequencing, suggest bacterial agents to be associated with this condition. We have isolated species of *Vibrio, Aeromonas* and, *Pseudomonas* from the external lesions and internal blood filtering organs of the affected fish. However, little is known about the epidemiology and underlying environmental drivers of this emerging disease, or its significance to the fishery. Our future proposed work includes elucidating the environmental correlates of this disease in wild and holding systems, and experimentally quantifying the impacts of environmental stressors on disease expression. As the red disease can severely impact the eel fishery and emerging aquaculture industry in the Chesapeake Bay, there is an urgent need to better understand its role in the decline of wild populations. Our results will support effective disease mitigation and management of eel losses, both in aquaculture and wild.

Amanpreet Kohli is a third-year Ph.D. student in the Aquatic Health Sciences Department at Virginia Institute of Marine Science. Her broad interests include disease ecology, stress physiology, and ecotoxicology with a focus on science education and outreach. Her research is focused on an emerging infectious disease of American eels in the Chesapeake Bay. She holds a B.Sc. in Microbiology, a M.Sc. in Environmental Studies, and a M.S. in Biology.

Mercury, Stress, and Feathers

Presenter: Casey Lee McLaughlin
Advisor: Dan Cristol
William & Mary,
Biology

In birds, the stress response is mediated by the hormone corticosterone (CORT). During acute stress, blood CORT levels transiently spike, facilitating the "fight or flight" response. Chronic stress, however, often results in chronically elevated CORT, which can negatively impact survival and reproduction. I am exploring the effect of a potential chronic stressor - environmental mercury (Hg) - on CORT in songbirds. The impact of this persistent, global, and bioavailable pollutant on CORT is unclear, despite several studies. All previous studies measured CORT in blood, which provides only a snapshot of CORT levels. Blood CORT and Hg also give no information on the recent history of exposure at a contaminated site. I am instead examining the relationship between Hg and CORT in feathers, using a feather CORT extraction and assay. This technique assesses CORT deposited in the feather over its weeks of growth, capturing the "average" CORT response over this period. To study the relationship between feather CORT and feather Hg in an uncontrolled polluted environment, I examined wren feathers from contaminated and control sites, focusing on a related migratory and resident species. The two species exhibited distinct Hg exposures and CORT levels. To better understand the effect of Hg alone on CORT, I will next examine feather CORT in a controlled captive setting, using zebra finches fed a known concentration of Hg. I hope to shed light on Hg's role as an endocrine disruptor, improve our mechanistic understanding of feather CORT, and validate its use as a bioassay of chronic stress.

Casey McLaughlin is a second-year M.S. candidate in the Biology Department at William & Mary. She is broadly interested in avian endocrinology and ecotoxicology. She is currently studying the impact of methylmercury exposure on stress hormones and feather physiology in songbirds. Before coming to William & Mary, Casey spent three years at Columbia University as a research assistant in neuroscience and molecular biology labs. She holds a B.S. in Chemistry and Psychology from Yale University

Population Structure, Gene Flow, and Conservation of Townsend's Big-Eared Bat (*Corynorhinus townsendii*) Throughout Nevada

Presenter: Megan Louise Moran
Co-Author: J. Steven
Advisor: Richard Sherwin
Christopher Newport University,
Environmental Science

Loss of genetic variation is of concern for threatened species, particularly those with small, fragmented populations, which are more susceptible to genetic drift, fixation of alleles, and inbreeding depression. Townsend's big-eared bat (*Corynorhinus townsendii*) is classified as a species of conservation priority by the Nevada Department of Wildlife and has relatively low dispersal rates, potentially limiting gene flow among aggregations. Our goal is to assess current genetic connectivity of Townsend's big-eared bat by evaluating genetic diversity, population structure, and gene flow. We collected wing tissue samples in the summer and fall of 2018 and 2019 from several maternity roost sites throughout Nevada. We plan to analyze nuclear (microsatellite loci) and mitochondrial DNA to determine the genetic relatedness of these maternity roost aggregations. Population connectivity plays an important role in maintaining genetic variation. In order to conserve threatened species, management strategies should seek to restore historic patterns of gene flow and discern the current genetic variation within and among populations.

Megan Moran is pursuing her Master's degree in Environmental Science at Christopher Newport University. Her research currently focuses on wildlife conservation and population genetics of Townsend's big-eared bat throughout Nevada. She hopes to answer questions regarding population structure, gene flow, and movement of individuals in the landscape.

Targeting DDI2 to Potentiate Proteasome Inhibitor-Induced Cell Death in Triple Negative Breast Cancer Cells

Presenter: Amy Northrop
Co-Author: J. Vangala
Advisor: Senthil Radhakrishnan
Virginia Commonwealth University,
Human and Molecular Genetics

Despite widespread proteasome addiction in cancer cells, proteasome inhibitors (PIs) have failed to effectively treat most types of cancer. One explanation is utilization of the NRF1-mediated proteasome bounce-back response, a compensatory cellular mechanism that occurs during proteasome inhibition to evade PI-induced cell death. The response requires the activation and nuclear translocation of a transcription factor, NRF1, which is proteolytically-cleaved into its active form by the protease DDI2. During proteasome inhibition, NRF1 promotes the transcriptional synthesis of new, uninhibited proteasomes via the activation of proteasome-related genes to relieve PI-induced cell stress and prevent apoptosis. The goal of this study was to evaluate DDI2 as a therapeutic target to inhibit the NRF1-mediated proteasome bounce-back response to potentiate PI-induced cell death of a triple negative breast cancer (TNBC) cell line in vitro. We found that DDI2-deficient TNBC cells are more sensitive to CFZ-induced cell death and expression of protease-dead DDI2 in the TNBC cells behaves in a dominant-negative fashion to impair NRF1 processing and potentiate CFZ-induced cell death. Previous attempts at using PIs alone or in combination with other cancer therapeutics have failed to effectively treat most types of cancer. A combinational approach using a DDI2 protease inhibitor with CFZ or other FDA-approved PIs may expand the repertoire of cancer types in which PIs can effectively kill cancer cells to improve patient outcomes.

Amy Northrop is a fourth-year Ph.D. candidate in the Human and Molecular Genetics Department at Virginia Commonwealth University. She is in a dual degree program to earn both her Ph.D. and a Master's degree in Genetic Counseling. Her research focuses on targeting the protease DDI2 in combination with proteasome inhibition to expand the repertoire of cancer types in which proteasome inhibitors can effectively treat patients.

The Impact of Acidic Conditions on Gene Regulation by the Two-Component System ArsRS in *Helicobacter pylori*

Presenter: Elisabeth Huntley Polanshek
Advisor: Mark Forsyth
William & Mary,
Biology

Helicobacter pylori is a Gram-negative bacterium that infects up to 50% of the world's population and causes gastric ulcers or cancer in a portion of those infected. The stomach creates a challenging niche for *H. pylori* in which it must survive pH fluctuations in order to colonize and persist in the gastric mucosa. One means of adaptation to acidic conditions is the two-component system ArsRS. The 3' terminus of the sensor histidine kinase ArsS is unusual due to a hypermutable homopolymeric cytosine tract that enables multiple isoforms to exist in a local population. My research focuses on determining the advantages that each isoform may provide *H. pylori* in regards to acid-induced gene expression. These isoforms will be examined using freeze frame mutants with decreased hypermutability in the poly-cytosine tract. Additional mutants include one with a nonfunctional poly-cytosine tract and one with a nonfunctional/truncated 3' coding sequence. All mutants will undergo acid shock tests to simulate the stomach environment. The samples will then be put through RNA Seq and subsequent qRT-PCR to identify and confirm respectively which genes are differentially expressed in different mutants. Genes identified as being of particular interest, such as genes of unknown function, will be deleted to determine their roles in acid acclimation. We hope to identify genes whose acid-induced expression is affected differentially by altered ArsS carboxy terminal domain isoforms. This information could be useful for identifying potential drug targets for novel antibiotic therapies.

Huntley Polanshek is a first-year M.S. student in the Biology Department at William & Mary. Her research interests include infectious disease and microbiology. Her thesis work focuses on the acid responsive gene regulation in Helicobacter pylori.

Effect of Cortisol Treatment *in Vivo* on Immune Response and Infection Prevalence in Rainbow Trout

Presenter: Fatima Quddos
Advisor: Patty Zwollo
William & Mary,
Biology

Pacific salmon migrate long distances to spawn as part of their life cycle. During migration, they undergo major endocrine, physiological and immune changes. Cortisol, the primary stress hormone, gradually increases during the journey. Persistent high cortisol levels have deleterious health effects, including suppression of the antibody immune response. Pathogens encountered during migration may stimulate the immune system. My research question focuses on how salmonids balance the immunosuppressive effects of high cortisol levels with activation of the antibody response. A recent field study from our lab showed a transient increase in abundance of B cells during the spawning run which is suggestive of activation of the immune system. In the current study, we investigated the antibody response under conditions of elevated levels of cortisol in rainbow trout under laboratory-controlled conditions. We looked at the effects of a) cortisol alone, b) fish pathogen *Flavobacterium psycrophilum* (Fp) alone and c) combined cortisol and Fp challenge on the gene expression of immunoglobulins IgM and IgT using qPCR. We found that cortisol suppresses the antibody response in Fp-susceptible (FpS) line but not in Fp-resistant (FpR) line of Rainbow trout. We also report that FpS fish show a strong, but delayed, adaptive immune response, while FpR fish are able to clear out the pathogen with lower, rapid, and presumably more successful, adaptive immune activation. Taken together, our data suggests that the antibody response in FpR line is less sensitive to increased cortisol levels.

Fatima Quddos is a second-year M.S. candidate in the Biology Department at William & Mary. Dr. Zwollo's lab's research interest is determining the molecular basis of immune system function in migrating salmonid species. They are currently exploring if migrating salmonids have evolved to manage high stress levels to evade the immuno-suppressive effects due to their peculiar life cycle.

Prophages Play a Role in Strain-Level Specificity in a Host-Microbe Association

Presenter: Elizabeth Ransone
Co-Author: D. Ginete
Advisor: Heidi Goodrich-Blair
University of Tennessee,
Microbiology

Host-microbe symbioses exist on a scale from antagonistic to mutualistic. We used the obligate *Xenorhabdus* bacterium and *Steinernema* nematode symbiosis to study how one type of interaction can vary along the symbiosis scale in a strain-specific way. *Steinernema* nematode hosts of *X. bovienii* bacteria respond differently depending on the strain of *X. bovienii* to which they are exposed. For example, *S. feltiae* can form compatible associations with *X. bovienii* strains isolated from nematodes within the same clade but are killed by those from a separate but closely related clade. Also, S. affine nematodes develop differently when grown on native and non-native *X. bovienii* strains. To visualize the strain differences on a genomic level, we used BRIG to compare 18 available draft and complete *X. bovienii* genomes. Each strain genome is ~20% different from those of the other strains. To test if genomic differences are explained by bacteriophage content, we used the program PHASTER to identify bacteriophages in all X. bovienii genomes. We found a total of 228 bacteriophages with few shared between strains. Currently, we are fully sequencing each genome to improve phage predictions. With fully sequenced genomes, we will investigate prophage-encoded proteins, including a hypothetical toxin that our preliminary data indicates influences nematode interactions. While bacteriophages represent some but not all genomic differences among X. bovienii strains, our findings support the idea that phages may play a role in the strain-level specificity of *X. bovienii-Steinernema* mutualisms.

Elizabeth Ransone is a first-year M.S. student in the Microbiology Department at the University of Tennessee, Knoxville. She is broadly interested in insect-vectored microbiology and the evolution and maintenance of such systems. She received her B.S. in Biology from William & Mary.

Speciation Dynamics of Diverging Monkeyflower

Presenter: Caroline Schlutius
Advisor: Joshua Puzey
William & Mary,
Biology

Hybridization, the merger of two genomes within one nucleus, is an important mechanism for creating genetic diversity. Hybridization allows for novel genetic interactions and allele combinations, which can lead to a wide array of new phenotypes. When a hybrid undergoes whole genome duplication, or polyploidy, the result is the immediate creation of a new species. This new species may ultimately diverge into different variations and ultimately speciate again. However, while we know about the immediate consequences of polyploidy on cellular processes and the consequences of polyploidy on lineages over evolutionary time, we know very little about how polyploidy affects the process of species divergence as it happens. This is critical to our understanding of evolution, however, given that polyploidy has taken place in at least 70% of angiosperm species. This project investigates how large-scale structural variants in DNA sequences across the genome contribute to diversification. It also aims to understand the unique role of polyploidy in these processes and how diversification may be promoted or hindered in polyploid lineages. To do this, individuals from two diverging morphotypes of an allopolyploid ancestor will be sequenced. We will then use whole genome sequencing data to locate structural variants across their genomes, determine whether structural variants are correlated with diverging sequences of DNA, and map the structural variants to the copy of the chromosome on which they reside. From this, we can better understand the process of speciation within polyploid lineages.

Caroline Schlutius is a second-year M.S. candidate in the Biology Department at William & Mary. Her research interests include evolutionary biology, genomics, and plant biology. Her thesis studies the evolutionary consequences of polyploidy on the plant genome and the unique effects caused by hybridization and genome duplication in polyploids. She holds a B.S. in Ecology and Evolutionary Biology from Yale University.

Biology of Robustness: SUMO & the Stress Tolerance in Yeast

Presenter: Yasaman Setayeshpour
Advisor: Oliver Kerscher
William & Mary,
Biology

SUMO, a small ubiquitin-like modifier protein, becomes attached to specific eukaryotic proteins to modulate their function and activity. The importance of SUMO modification in cell cycle progression, transcriptional regulation, and DNA damage-related processes has been firmly established. In contrast, a SUMO-dependent Stress Response (SSR) exists, but this process remains ill-defined. When cells are exposed to proteotoxic and genotoxic stressors, the SSR involves a rapid and dramatic increase in SUMO-modified proteins. The SSR is believed to play a cytoprotective role for normal cells, but it may also enhance the robustness of cancerous cells and eukaryotic pathogens. To investigate the role that SUMO and SUMO pathway components play in stress tolerance, we utilize the stress tolerant yeast *Kluyveromyces marxianus* (Km). Unlike *Saccharomyces cerevisiae* (Sc) cells, Km cells thrive at temperatures of up to 49°C and are highly resistant to oxidative stress and UV irradiation. We have cloned nine genes of the SUMO pathway from the stress-tolerant Km to determine their contribution to stress tolerance. Using CRISPR/Cas9 technology, we are replacing these Sc SUMO pathway genes at their corresponding Km orthologs. Results from our experiments reveal that replacements of some Sc SUMO pathway genes with their Km orthologs enhances Sc cell resistance to oxidative stress and DNA damage. Ultimately, we seek to understand how adaptive genetic variations in SUMO pathway genes promote stress resilience.

Yasaman Setayeshpour is a second-year M.S. candidate in the Biology Department at William & Mary. She has a broad interest in the study of functional consequences due to genetic variants. She is currently investigating the involvement of certain proteins in stress tolerance in yeast.

Developing an Acoustic Warning Signal to Reduce Bird Collisions

Presenter: Robin Grace Thady
Co-Author: T. Boycott
Advisor: John Swaddle
William & Mary,
Biology

Bird populations have experienced a dramatic decline across North America, and collisions with human-made structures are a major contributor to avian mortality. In addition to the loss of avian biodiversity and resulting ecological cascades, collisions impose significant financial burdens on a variety of industries. To avert further bird declines and collision-related economic liabilities, it will be essential to find ways to effectively reduce bird strikes. Existing collision-reduction strategies include visual warnings designed to make potential obstacles more conspicuous to birds. However, these methods have largely proven insufficient as many birds predominantly look downward while in flight and are essentially blind in the direction of travel. Acoustic deterrents could be used to supplement visual warnings, targeting multiple sensory systems to increase the likelihood that birds detect an obstacle with enough time to redirect or slow their flight and avoid a collision. Previous studies have demonstrated that acoustic signals redirect bird flight away from collision hazards, yet more research is necessary to determine the most detectable and alarming types of sounds to use in auditory warnings. To determine the detectability of different sounds to birds in flight, I will release birds into a flight tunnel, where they will be exposed to a variety of warning signals upon approach to a collision obstacle. Using three-dimensional flight tracking, I will measure velocity and flight trajectory to determine which signals most effectively reduce collision risk.

Robin Thady is a first-year M.S. student in the Biology Department at William & Mary. She is interested in how anthropogenic stressors impact animal behavior and how increasing the understanding of animal behavior can be used to develop novel solutions for conservation issues. For her master's thesis, she is working to develop an acoustic warning signal to deter birds from colliding with human-made structures.

Altered Intracellular Trafficking of Mutant Thyroid Hormone Receptors in Resistance to Thyroid Hormone Syndrome

Presenter: Hannah Page Tofil
Advisor: Lizabeth Allison
William & Mary,
Biology

A protein's intracellular location is an integral part of its function. Mislocalization can cause protein dysfunction and leave an individual susceptible to diseases such as type II diabetes, certain cancers, and Resistance to Thyroid Hormone Syndrome (RTH). Such is the case for the thyroid hormone receptor α 1 (TRα1), a protein that when mutated causes RTH. This receptor binds to thyroid hormone (T3) and acts as a transcription factor in the nucleus. As such, maintenance of TRα1's nucleocytoplasmic shuttling and intranuclear dynamics is essential to ensure proper protein function. Prior studies have demonstrated that certain RTH TRα1 mutants have an increased affinity to one of TRα1's regulators, nuclear corepressor 1 (NCoR1), and form a more stable complex compared to wild type TRα1. This suggests that the mutants' intranuclear mobility would decrease relative to their wild type counterpart, and that nucleocytoplasmic shuttling would be impacted. The aim for my thesis is to evaluate the dynamics of RTH TRα1 mutants αR-E403X, Ala382ProfsX7, and F397fs406X in response to increased levels of NCoR1. The intranuclear dynamics of each mutant RTH TRα1 will be evaluated in human cells using fluorescence recovery after photobleaching (FRAP) compared to wild type, and statistically analyzed for significance. Nucleocytoplasmic shuttling ability of the mutants and wild type TRα1 will be evaluated using heterokaryon assays. With this study, I hope to provide valuable insight into the impact of receptor mislocalization in disease pathogenesis.

Hannah Page Tofil is a first-year student in the Biology Department at William & Mary. She is currently investigating the molecular mechanics of Resistance to Thyroid Hormone Syndrome. She holds a B.A. in Biology from the University of Vermont.

Brucella abortus is Recognized by the Inflammasome and Negative Regulator NLRX1 of the Innate Immune System

Presenter: Juselyn Tupik
Co-Authors: C. Caswell, S. Coutermarsh-Ott, A. Hollis Benton, K. King
Advisor: Irving Coy Allen
Virginia Tech-Maryland College of Veterinary Medicine,
Biomedical & Veterinary Sciences

Brucella abortus, a bacteria that causes the zoonotic disease brucellosis, is relatively understudied in the context of innate immune system recognition. Pattern recognition receptors (PRRs) play a key role in this system by recognizing pathogens and promoting the expression of cytokines to inhibit or promote an immune response. One such PRR is NLRX1 (NLR family), a negative modulator of innate immunity that inhibits the expression of proinflammatory cytokines. In contrast, the adaptor protein ASC promotes inflammation by complexing with many PRRs to form the inflammasome, which acts as a central signaling hub. The activation of both NLRX1 and ASC in response to a *B. abortus* has not been previously determined. Therefore, we used macrophages from wild type, Nlrx1$^{-/-}$, and Asc$^{-/-}$ mice to elucidate the RNA expression and protein secretion of proinflammatory cytokines in response to *B. abortus* infection. Additionally, *in vivo* infections in Asc$^{-/-}$ mice were conducted to determine the mortality rates and protein expression of proinflammatory cytokines. We found that Nlrx$^{-/-}$ macrophages exhibited increased expression of proinflammatory cytokines, while Asc$^{-/-}$ exhibited decreased expression and secretion. Asc$^{-/-}$ mice also showed higher mortality and decreased proinflammatory signaling in the liver and spleen than wild type mice. This may indicate that *B. abortus* interacts with both the inflammasome and NLR PRRs in the innate immune system. Further studies determining the immune recognition of *B. abortus* are essential for the development of effective brucellosis treatments.

Juselyn Tupik is a first-year D.V.M./Ph.D. student in the Biomedical & Veterinary Sciences Department at the VA-MD College of Veterinary Medicine at Virginia Tech. She is investigating how infectious diseases are recognized and targeted by the innate immune system. She obtained her B.S. in Biology from William & Mary in 2019.

UNDERGRADUATE RESEARCH WEEK

Creative • New • Knowledge

March 27 - April 5

WILLIAM & MARY
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THE CHARLES CENTER

SCHEDULE OF EVENTS:

Friday, March 27

•**SHARP SEMINAR** • Student Journalism Showcase • 4 - 6 PM • *Blow 201*
•**EUROPEAN STUDIES** • Student Faculty Research Conference • 5 - 6 PM • *Tucker 127A*

Saturday, March 28

•**EUROPEAN STUDIES** • Student Presentations • 9 AM - 12:15 PM • *Tucker 127A*

Sunday, March 29

•**ORCHESIS MODERN DANCE** • Student Dance & Choreography • 2 - 3:30 PM • *Kimball Theatre*

Monday, March 30

•**ART & ART HISTORY** • Curatorial Team Presentations • 3:30 - 5 PM • *Muscarelle Museum*
•**CHARLES CENTER** • Undergraduate Research Week Reception • 5:30 - 6:30 PM • *Andrews Hall Lobby*
•**ART & ART HISTORY** • Non-Majors Studio Art Exhibition • 6 - 7 PM • *Andrews Gallery*

Tuesday, March 31

•**GLOBAL RESEARCH INSTITUTE** • Lightning Talks • 6 - 8 PM • *427 Scotland Street*

Wednesday, April 1

•**CIVIC AGENCY PROJECT** • Theory and Practice • 11:30 AM - 12:50 PM • *Sadler Center Tidewater A*
•**WMSURE** • Research Workshop • 4:30 - 6 PM • *Swem's Ford Classroom*
•**WOODY INTERNSHIP IN MUSEUM STUDIES** • Student Research Presentations • 6 - 7 PM • *Blow 201*

Thursday, April 2

•**HONORS FELLOWS** • Flash Theses • 2 - 3 PM • *Online live stream*
•**BIOLOGY** • Bioengineering & iGem Showcase • 12 - 1 PM • *Integrated Science Center lobby*

Friday, April 3

•**ART & ART HISTORY** • Senior Research Colloquium • 9 AM - 4 PM • *Muscarelle Museum*
•**BIOMATHEMATICS JOURNAL CLUB** • Seminar on Undergraduate Research • 12 - 12:50 PM • *ISC 3020*
•**RUSSIAN & POST-SOVIET STUDIES** • Research Colloquium • 12 - 1 PM • *Blow Hall 334*
•**CENTER FOR GEOSPATIAL ANALYSIS** • Geospatial Research Symposium • 12 PM - 3 PM • *Blow 201*
•**SPRING UNDERGRADUATE RESEARCH SYMPOSIUM** • 2 - 4:30 PM • *Integrated Science Center lobby*
•**SHARPE SCHOLARS** • Engaged Scholarship Symposium • 2 - 4:30 PM • *ISC*
•**DATA SCIENCE** • geoLab Research Accelerator • 4:30 - 5:30 PM • *Swem's Ford Classroom*
•**CHARLES CENTER** • Research Proposal Showdown • 6:30 - 7:30 PM • *Swem's Ford Classroom*

Saturday, April 4

•**LINGUISTICS** • Virginia Area Linguistics Conference • 9 AM - 6 PM • *Blow 201*

Saturday & Sunday, April 4 & 5

•**PHILOSOPHY CLUB** • Undergraduate Philosophy Conference • (time and place TBA)

Synthesis and Characterization of Naphtochromene Derivatives Utilizing a Recently Developed Cascade Reaction

Presenter: Caleb Lee Burns
Advisor: Robert Hinkle
William & Mary,
Chemistry

Chromenes and their derivatives have been found to exhibit a diverse breadth of beneficial biological functionalities, such as anti-tumor and antioxidant properties, making optimization of their synthetic route a desirable field of study. In order to expand access to available derivatives, the scope of a BF_3•OEt_2-mediated cascade reaction forming 6H-naphtho[2,1-c]chromene derivatives is explored. The cascade is initiated by intermolecular addition of an alkyne substrate's phenol moiety to a BF_3¬-activated aldehyde to form an electrophilic oxo-carbenium ion. This change in chemical functionality permits an alkyne-Prins cyclization to occur, which, in turn, creates the conditions for an intramolecular Friedel-Crafts reaction. Lastly, the molecule is rearomatized through a final elimination step forming the desired 6H-naphtho[2,1-c]chromenes. Altering the electronic characteristics of the ring responsible for the Friedel-Crafts reaction alongside utilization of differing aldehydes produced yields that varied from 10% to 70% depending upon electrophilicity of the aldehyde and subsequent oxo-carbenium ion, as well as the use of either electron donating groups or withdrawing groups causing deactivation of the Friedel-Crafts carbon to different extents. Addition of two methyl groups at activating positions surprisingly has been shown to decrease yields due to severe steric hindrance, elucidated by X-ray crystallographic analysis. These derivatives are expected to express unique electronic properties which are to be further characterized by absorbance and fluorescence spectroscopies.

Caleb Burns is a first-year M.S. student in the Chemistry Department at William & Mary. He earned a B.S. in Chemistry at William & Mary where he did research in organic synthesis with Dr. Abelt. He has since gone on to further his academic career here at the university expounding on the skills and knowledge conferred in his undergraduate experience. Caleb is now working in Dr. Hinkle's lab doing research in organic synthesis and hopes to eventually earn his Ph.D. in Chemistry.

Study of Epoxies Using Single-Sided NMR

Presenter: Kayla Ann Copeman
Co-Authors: A. Balachandra, K. Keating, E. Kim
Advisor: Tyler Meldrum
William & Mary,
Chemistry

The use of epoxy resins for aerospace and aircraft applications are extensive due to the longevity and versatility of their physical properties. Determination of curing kinetics provides insight that is useful for quality control and defect detection for such applications. Single-sided NMR provides a nondestructive and inexpensive method for probing epoxy materials and spatially resolving the decay of the spin-lattice and spin-spin relaxation rates (T1 and T2) during and after curing of epoxy resins onto substrates. Analysis of T1 and T2 can provide insight on rotational and translational motion of molecules within epoxy materials since both parameters depend on molecular mobility. Research performed in our lab has found that the relaxation decay rate (T2) of Epon 825/Jeffamine-D230, Epon 825/Jeffamine-D400, and MX 960/Jeffamine-D230 mixtures is larger in the bulk of the sample than at the interface of a substrate. Studies analyzing the effect of water immersion and heat on cured epoxy materials are being conducted to determine the durability of the resins under various conditions. The effect of varying amine curing agent linker lengths on T1 and T2 of epoxy resins will be analyzed to reveal its effect on data and physical properties of the cured products.

Kayla Copeman is a first-year M.S. student in the Chemistry Department at William & Mary. Her research includes using single-sided NMR, FTIR, and DSC to study epoxy systems in various conditions. She recently graduated Magna Cum Laude with a B.S. in Chemistry and a minor in Business from the University of Lynchburg.

Chemical Transformation of Tungsten Oxides as Ion Intercalating Electrochromic Materials

Presenter: Anyang Hu
Advisor: Feng Lin
Virginia Tech,
Chemistry

Although many metal oxides have electrochromic properties, only those with superior durability, larger optical modulation, and faster switching kinetics are expected to be used commercially. Among them, the durability during long-term electrochemical intercalation and deintercalation processes has increasingly become an apparent problem, and its underlying mechanism has not been systematically studied. In this work, we investigate the long-term durability of semi-crystalline WO_3 thin films in the sulfuric acid electrolyte, with the focus on elucidating the mechanism of degradation. Through an in-depth analysis of electron microscopy, electron spectroscopy, X-ray diffraction, and X-ray absorption spectroscopy, we discover that crystal structure, morphology, and ion-(de)intercalation kinetics of WO_3 thin films have evolved at multiple length scales, all of which were related to the degradation. Our work provides a new perspective to improve the durability of electrochromic thin films by mitigating the metal dissolution and crystal reformation.

Anyang Hu is a second-year Ph.D. student in the Chemistry Department at Virginia Tech. He has a broad interest in ion intercalation chemistry and crystal defect chemistry, especially in the fields of electrochromic metal oxides and lithium-ion batteries. He holds a B.S. (Materials Science and Engineering) from Hubei University and an M.S. (Material Science) from the University of Florida.

Synthesis, Separation, and Characterization of Aqueous Colloidal Suspensions of Fullerene Epoxide

Presenter: Jesse R. Ingham
Co-Author: M. Garner
Advisor: Rangika Hikkaduwa Koralege
Western Carolina University,
Chemistry

Fullerenes are among the most attractive carbon nanomaterials and have wide-spread applications including electronics, automobile, aircraft, and energy. Stable aqueous suspensions of fullerenes (known as nano-C_{60}) are poorly understood complex systems where with subtle effects of their specific synthetic method and surface chemistry dominate its stability and reactivity. Nano-C_{60} has been shown to induce toxicity in numerous cell cultures and whole animal systems. However, contradictory reports in the literature make it difficult to interpret the mechanism by which fullerene toxicity is induced. Nano-C_{60} suspensions are demonstrated to rely on the [6,6]-closed epoxide derivative of the fullerene (known as $C_{60}O$) for stability and it is possible that $C_{60}O$ plays a key role in the observed behavior of these suspensions. Our final goal is to elucidate the extent and mechanism of oxidative toxicity caused by these materials and this project is focused on the synthesis, separation, and isolation of $C_{60}O$ using semi-preparative HPLC, and evaluation of colloidal properties. We have synthesized C_{60}, $C_{60}O$, and $C_{60}O_2$ compounds by ozonating solutions of C_{60} in toluene and achieved excellent separation of compounds using a mixture of toluene/n-hexane mobile phase in a semi-preparative column. Each isolated compound has been analyzed by UV-Vis spectroscopy and the maximum absorbencies were determined to be 336, 328, and 314 nm for C_{60}, $C_{60}O$, and $C_{60}O_2$ respectively. Aqueous colloidal suspensions prepared by $C_{60}O$ showed an average hydrodynamic colloidal particle size of 145 nm.

Jesse Ingham is a second-year M.S. candidate in in the Chemistry and Physics Department at Western Carolina University. His research areas include analytical, environmental, inorganic, organic, and physical chemistries. His Master's Thesis topic is the Synthesis, Separation, and Characterization of Oxidative Behavior of Aqueous Colloidal Suspensions of Fullerene Oxide ($C_{60}O_{(aq)}$). He holds a B.A. in Chemistry, from the University of North Carolina, Asheville.

Copper Iodide Nitropyridine Complexes as Luminescence Detectors

Presenter: Matthew D. Kessler
Co-Authors: W. Lain, T. Duston de Villereglan
Advisor: Robert Pike
William & Mary,
Chemistry

The reaction of CuI and 3-nitropyridine ($3PyNO_2$) produces $CuI(3PyNO_2)$. X-ray crystallography reveals both ladder $[Cu_2I_2(3PyNO_2)_2]$? and cubane $[CuI(3PyNO_2)]_4$ phases. This compound evidences a deep red color to the eye but does not show emission under ultraviolet light irradiation. Computational studies were utilized to investigate band gap behavior to explain the unusual non-emissive nature of this material. The weakly coordinating $3PyNO_2$ ligand is readily displaced by other pyridine and sulfide ligands (L), converting the non-emissive CuI ($3PyNO_2$) compound to emissive products CuILn under UV. The ready conversion from a non-emissive copper(I) nucleophile adduct to an emissive one with spontaneous replacement of the nucleophile offers proof-of-concept for chemical sensing applications. Results for other nitroaromatic and cyanoaromatic complexes of CuI are also presented.

Matthew Kessler is a first-year M.S. student in the Chemistry Department at William & Mary. His research interests include chemical sensors and charge transfer complexes. His current work focuses on organometallic copper complexes and lanthanide chemistry.

Identification of a Novel Transcriptional Repressor Gene in Kumao, a Novel Temperate Bacteriophage

Presenter: Lori Neri
Advisor: Maria Gainey
Western Carolina University,
Chemistry

Bacteriophages (viruses that infect bacteria) are the most abundant biologic entities on the planet. During the lytic replication cycle bacteriophage infection results in cell death and the production of many new infectious bacteriophage particles. Temperate bacteriophages express an integrase protein that allows them to integrate their genome into the bacterial chromosome. The integrated bacteriophage is called a prophage, and the bacterial cell containing it is called a lysogen. During lysogeny, bacteriophage lytic gene expression is silenced via the expression of a transcriptional repressor protein. While it is known that many bacteriophages are temperate, only a few repressor proteins have been biochemically characterized. Kumao is a genetically unique bacteriophage that infects *Mycobacterium smegmatis*. Kumao contains an integrase gene on the right side of the genome, and is temperate but a repressor gene candidate has not yet been identified. Our current work is focused on identifying Kumao's repressor gene using two different functional screens. The first involves overexpressing individual Kumao genes in *Mycobacterium smegmatis* and performing a viral challenge experiment. The second approach involves CRISPR interference of Kumao's operons during lysogeny. If the operon containing the repressor is silenced during lysogeny, Kumao should reenter the lytic replication cycle. The results of these experiments and future plans for the biochemical characterization of Kumao's repressor protein will be discussed.

Lori Neri is a second-year M.S. candidate in the Chemistry and Physics Department at Western Carolina University. Her research area includes studying bacteriophages that infect Mycobacterium smegmatis *and their repressor proteins.*

Solvent Extractions off Indoor Surfaces: Development of an Extraction Method

Presenter: Hannah Przelomski
Co-Authors: J. Mesawich, G. Ge
Advisor: Rachel O'Brien
William & Mary,
Chemistry

People spend around 90% of their time indoors. Because of this, the chemistry that occurs in indoor environments can have a large impact on human health. Indoor air contains a mixture of volatile organic compounds (VOC) and organic aerosol particles. The concentrations and identities of these chemicals will play large role in the healthiness of indoor spaces. The aerosol particles and the semi-volatile portion of VOCs can be transported in the air around the room and can deposit/partition onto different indoor surfaces. Due to the high surface area to volume ratio indoors, surfaces can have a big impact on indoor air. Current methods for collecting surface samples typically involve wiping the surface with a piece of clean disposable cloth. This method presents some difficulties including a lack of consistency between wipes and possible contamination. Here, we have designed and built an extractor to investigate organic material on indoor surfaces using direct solvent extraction. The surface extractor has been used to sample multiple different indoor surfaces including time series analysis of a kitchen. These samples are characterized using two types of mass spectrometry: soft ionization and aerosol mass spectrometry. We find good extraction efficiencies ~40-50% and clean backgrounds. The soft ionization method demonstrates differences in the chemical composition by surface location/type in the kitchen indicating local emission/deposition events. The aerosol mass spectrometer provides insights into aging with more oxidized/aged material observed further from a direct source.

Hannah Przelomski is a second-year M.S. candidate in the Chemistry Department at William & Mary. Her area of research focuses on material that is found on indoor surfaces and how to collect and analyze this material. Currently, she is working on an extractor that will allow sampling of this material.

Structural Dependence of Charge Transfer in Conjugated Polymer Nanoparticles

Presenter: Jaclyn Rebstock
Advisor: Elizabeth Harbron
William & Mary,
Chemistry

Conjugated polymer nanoparticles (CPNs or Pdots) have become popular fluorophores for a variety of fluorescence imaging applications due to their brightness, photostability, and aqueous compatibility. Recently, their ability to generate charged species has begun to be exploited in applications ranging from photocatalysis to photodynamic therapy. Upon excitation, CPNs can eject an electron via photoinduced electron transfer (PET) to oxygen or other acceptors. PET generates a hole in the CPN, which quenches its fluorescence. These processes are thus undesirable for fluorescence-based applications due to the reduction in fluorescence intensity. However, for redox-based applications such as photodynamic therapy and solar cells, PET becomes desirable regardless of fluorescence quenching. We seek to determine the dependence of PET on conjugated polymer structure and irradiation dosage. We will present studies of PET and the concomitant fluorescence quenching in the most widely-used CPNs. These results will ultimately aid in the selection of polymers and irradiation conditions for CPN-based applications.

Jaclyn Rebstock is a second-year M.S. candidate in the Chemistry Department at William & Mary. Her research interests are in photochemistry and she is ultimately interested in pursuing ultrafast spectroscopy research. Currently, she is exploring charge transfer in conjugated polymer nanoparticles.

Impact of Aggregation on the Electron Injection of Eosin Y in Dye-Sensitized Solar Cells

Presenter: Huw E. Richards
Advisor: Kristen Wustholtz
William & Mary,
Chemistry

It is widely acknowledged that global energy demand will exceed 27.6 TW (i.e., $244000 or 4500 barrels of oil per second) by 2050. As climate change and energy demands continue to escalate, it is imperative to develop alternatives to fossil fuel energy sources. One promising strategy toward renewable energy is dye-sensitized solar cells (DSSCs), an alternative to expensive conventional solar cells. DSSCs are comprised of dye molecules absorbed on a nanocrystalline semiconductor substrate, which enable the conversion of incoming solar energy into an electric current. Eosin y (EY) is fluorescein-based chromophore that has been successfully employed in dye-sensitized solar energy conversion. However, it is well known that dyes like EY can form aggregates on the semiconductor substrate, which exhibit altered light absorbing and electron transfer properties as compared to monomers of the same dye. Previous studies have shown that molecular aggregation can be either beneficial or detrimental to the solar cell conversion efficiencies, but the aggregation behavior of EY in these systems is unknown. Here, the aggregation of EY on semiconductor films is investigated using steady-state and time-resolved spectroscopies, both to determine the type of aggregation and the corresponding injection yield of the films. EY is shown to aggregate even at low dye-loading concentrations and the injection yield is decreased as additional aggregates are formed, implying aggregation inhibits injection from the dye to the semiconductor.

Huw Richards is a second-year M.S. candidate in the Chemistry Department at William & Mary. He has interests in laser spectroscopy particularly in single molecule spectroscopy and time correlated single photon counting. His current work is focused on the injection dynamics of eosin y when it is used as a sensitiser in dye sensitised solar cells.

Structural Comparison of Group 12 Complexes of a Tripodal Mixed NS Donor Ligand

Presenter: Matthew Sturner
Co-Authors: J. Owusu-Koramoah, S. Berry, R. Pike
Advisor: Deborah Bebout
William & Mary,
Chemistry

Two new group 12 metal ion complexes of the N_3S ligand 2-[bis(2-pyridinylmethyl)amino]ethanethiol (LH) with chemical formulas $[CdLCl]_2$ and [HgLCl] were synthesized for comparison with the known complex [ZnLCl]. The new complexes were thoroughly characterized using X-ray crystallography, ^{1}H NMR, elemental analysis, and IR. The dimeric Cd(II) complex had octahedral metal coordination geometry while the mononuclear Zn(II) and Hg(II) complexes had trigonal bipyramidal (τ = 0.82) and mixed square pyramidal/trigonal bipyramidal (τ = 0.44) coordination geometries, respectively. Both the mercury and cadmium complexes exhibited heteronuclear coupling in the ^{1}H NMR between the metal centers and specific ligand protons indicating slow ligand exchange on the coupling constant time scale and unusual stability for thiolate complexes of these metal ions. These structural comparisons give some insight into the physiological differences between these group 12 metal ions.

Matthew Sturner is a first-year M.S. student in the Chemistry Department at William & Mary. His research is in inorganic chemistry, with a focus on the elements of Group 12. He holds a B.S. in Chemistry from William & Mary.

The Influence of Overcharging Protocol in the Aqueous Battery System

Presenter: Yuxin Zhang
Advisor: Feng Lin
Virginia Tech,
Chemistry

Sodium-ion aqueous batteries, with the advantages of low cost and high safety factor, are the promising candidate to substitute lithium-ion batteries. However, the narrow operation voltage window induced by water decomposition significantly limits their extensive application. More effective methods are needed to address such issue and improve the output energy density. Herein, we successfully converted a Na-poor pristine material to a Na-rich material through electrochemical overcharging. The Na-rich material we synthesized has dramatically elevated energy density, from initially ~45Wh/Kg to ~120Wh/Kg. In addition, the as-prepared Na-rich material has stable cycle life. Counter-intuitively, water decomposition at high voltage plays an essential role in improving the performance of our Na-rich material. This study illustrates the significance and benefits of overcharging protocol in the aqueous battery system and potentially provides a novel strategy to improve the electrochemical performance of other aqueous battery materials at a low cost.

Yuxin Zhang is a second-year Ph.D. candidate in the Chemistry Department of Virginia Tech. His research mainly focuses on battery cathode materials, exploring their performance and structural evolution upon electrochemical cycling.

Analyzing and Leveraging Remote-Core Bandwidth for Enhanced Performance in GPUs

Presenter: Mohamed Assem Ibrahim
Co-Authors: H. Liu, O. Kayiran
Advisor: Adwait Jog
William & Mary,
Computer Science

Bandwidth achieved from local/shared caches and memory is a major performance determinant in Graphics Processing Units (GPUs). These existing sources of bandwidth are often not enough for optimal GPU performance. Therefore, to enhance the performance further, we focus on efficiently unlocking an additional potential source of bandwidth, which we call as remote-core bandwidth. The source of this bandwidth is based on the observation that a fraction of data (i.e., L1 read misses) required by one GPU core can also be found in the local (L1) caches of other GPU cores. In this paper, we propose to efficiently coordinate the data movement across cores in GPUs to exploit this remote-core bandwidth. However, we find that its efficient detection and utilization presents several challenges. To this end, we specifically address: a) which data is shared across cores, b) which cores have the shared data, and c) how we can get the data as soon as possible. Our extensive evaluation across a wide set of GPGPU applications shows that significant performance improvement can be achieved at a modest hardware cost on account of the additional bandwidth received from the remote cores.

Mohamed Assem Ibrahim is a Ph.D. candidate in the Department of Computer Science at William & Mary under the supervision of Professor Adwait Jog. Mohamed's research interests lie in the broad area of computer architecture, with an emphasis on designing high-performance and energy-efficient GPU architectures. Before joining William & Mary, he received his bachelor's and master's degrees in Computer Engineering at Cairo University, Egypt.

BCoal: Bucketing-Based Memory Coalescing for Efficient and Secure GPUs

Presenter: Gurunath Kadam
Co-Author: D. Zang
Advisor: Adwait Jog
William & Mary,
Computer Science

Graphics Processing Units (GPUs) are becoming a de facto choice for accelerating applications from a wide range of domains ranging from graphics to high-performance computing. As a result, it is vital to improve the cooperation between traditional CPUs and GPUs. Given the growing security concerns in the CPU space, close integration of GPUs has further expanded the attack surface. Therefore, it is very challenging to keep emerging CPU-GPU heterogeneous systems secure while maintaining their performance and energy efficiency. In particular, side-channels have become a significant attack vector (such as Spectre and meltdown attacks) in the CPU world. Similarly, several side-channel attacks are also now being exposed in the GPU world – a recent attack showed that AES private keys can be recovered by exploiting the relationship between the number of coalesced memory accesses and total execution time. The state-of-the-art defence mechanisms against such GPU attacks incur high performance overheads and are insecure in the presence of other bandwidth optimization techniques. To defend against the correlation timing attacks, we propose a bucketing-based coalescing mechanism, BCoal, that significantly reduces the information leakage by always issuing predetermined numbers of coalesced accesses (called buckets). BCoal generates an optimal number of padded accesses to meet the bucket sizes. Furthermore, BCoal remains secure in the presence of other bandwidth optimization techniques. In summary, BCoal significantly improves GPU security at a modest performance loss.

Gurunath Kadam is a fourth-year Ph.D. candidate in the Computer Science Department at William & Mary. He has broad interest in the graphical processing unit (GPU) platform, and its security and reliability. Previously, he worked on the mitigation of correlation timing attacks on GPUs. Currently, he is exploring the faults and their impact on GPUs to evaluate their reliability.

Why GPUs are Slow at Executing NFAs and How to Make Them Faster

Presenter: Hongyuan Liu
Co-Author: S.P. Pai
Advisor: Adwait Jog
William & Mary,
Computer Science

Non-deterministic Finite Automata (NFA) are space efficient finite state machines that have significant applications in domains such as pattern matching and data analytics. In this paper, we investigate why the Graphics Processing Unit (GPU) – a massively parallel computational device with the highest memory bandwidths available on general-purpose processors – cannot efficiently execute NFAs. First, we identify excessive data movement in the GPU memory hierarchy and describe how to effectively use the GPU's memory hierarchy to privatize reads to limit this excessive data movement. We also show that in several cases, indirect table lookups in NFAs can be eliminated by converting memory reads into computation, to further reduce the number of memory reads. Although our optimization techniques significantly alleviate these memory-related bottlenecks, a side effect of these techniques is the static assignment of work to cores. This leads to poor compute utilization, where GPU cores are wasted on idle NFA states. Therefore, we propose a new dynamic scheme that effectively balances compute utilization with reduced memory usage. Our combined optimizations provide a significant improvement over the previous state-of-the-art GPU implementations of NFAs. Moreover, they enable current GPUs to outperform the domain-specific accelerator for NFAs (i.e., Automata Processor) across several applications while performing within an order of magnitude for the rest of the applications.

Hongyuan Liu is a third-year Ph.D. candidate in the Department of Computer Science at William & Mary. His advisor is Adwait Jog. His research interests are computer architectures and high-performance computing.

Towards a Natural Perspective of Smart Homes for Practical Security and Safety Analyses

Presenter: Sunil Manandhar
Co-Authors: K. Moran, K. Kafle, R. Tang, D. Poshyvanyk
Advisor: Adwait Nadkarni
William & Mary,
Computer Science

Designing practical security systems for the smart home is challenging without the knowledge of realistic home usage. We describe the design and implementation of Helion, a framework that generates natural home automation scenarios by identifying the regularities in user-driven home automation sequences, which are in turn generated from routines created by end-users. Our key hypothesis is that smart home event sequences created by users exhibit inherent semantic patterns, or naturalness that can be modeled and used to generate valid and useful scenarios. To evaluate our approach, we first empirically demonstrate that this naturalness hypothesis holds, with a corpus of 30,518 home automation events, constructed from 273 routines collected from 40 users. We then demonstrate that the scenarios generated by Helion seem valid to end-users, through two studies with 16 external evaluators. We further demonstrate the usefulness of Helion's scenarios by addressing the challenge of policy specification, and using Helion to generate 17 security/safety policies with minimal effort. We distill 16 key findings from our results that demonstrate the strengths of our approach, surprising aspects of home automation, as well as challenges and opportunities in this rapidly growing domain.

Sunil Manandhar is a fourth-year Ph.D. candidate in the Computer Science Department at William & Mary. His research areas include Internet of Things (IoT) security, privacy, and application security. He is currently exploring how Natural Language Processing (NLP) techniques can be used to improve security and privacy in emerging IoT platforms. He holds Bachelors in Computer Science and Information Technology (B.Sc.CSIT) from Tribhuwan University, Nepal.

A Hybrid Incremental Singular Value Method

Presenter: Jeremy Myers
Advisor: Andreas Stathopoulos
William & Mary,
Computer Science

Modern datasets continue to grow in size as technologies to collect and store big data become more widespread. The need has also grown for low-cost representations that keep only important features. Often data is stored in matrices with low-cost representations or low-rank approximations through the singular value decomposition (SVD). Since traditional methods for computing the SVD scale poorly as problem sizes grow, iterative methods are used to solve large problems. If the data is streamed, the full matrix is never available and the true SVD cannot be computed. Incremental SVD methods store only a window of the data each time and update a low-rank approximation on the fly. They typically use small windows so that the SVD can be carried out efficiently. However, larger windows achieve better accuracy of the low-rank approximation. The technology proposed in this work, the Hybrid Incremental Singular Value Decomposition (HiSVD), is an engineering solution to approximate the SVD of a large, sparse matrix in the streaming setting. HiSVD updates a small, dense low-rank approximation by appending large amounts of sparse data and computing the SVD iteratively. HiSVD is only a small factor more expensive than the iterative solver it uses. HiSVD is effective in producing accurate approximations of sparse matrices where there is a large spectral distance between the important features and those that are not. This work demonstrates the successes and limitations of HiSVD in different streaming settings with respect to cost, accuracy, and sparsity in the data.

Jeremy Myers is a third-year Ph.D. candidate in the Computer Science Department at William & Mary. His research areas include scientific computing, eigenvalue problems, sparse tensor factorizations, machine learning, data science, and high performance computing. He holds a B.A. in International Affairs from James Madison University, and a B.S. & M.S. in Applied Mathematics from Virginia Commonwealth University.

Neuron Manifold Distillation for Edge-Cloud Deep Learning Systems

Presenter: Zeyi Tao
Co-Author: Q. Xia
Advisor: Qun Li
William & Mary,
Computer Science

Despite the deep convolutional neural networks (CNNs) show their extraordinary power in various object detection tasks, they are infeasible to be deployed on the resource constraint devices or embedded systems due to its high computational cost and the training data exploding. Efforts such as model compression have been used at the expense of accuracy loss. Recent approach knowledge distillation (KD) based on a student-teacher paradigm aims at transferring model knowledge from a well-trained model (teacher) to a smaller and fast model (student) which can significantly help the deep CNNs to be widely applied. However, along with the improvements on model deployability, the conventional KD methods result in low model generalization ability and accuracy loss. In this work, we propose a novel approach, neuron manifold distillation (NMD), that student model instead of mimicking teacher's output activations, it also learns the feature geometry structure of the teacher ensembles. Therefore, we harvest a high-quality, compact, and lightweight student model. The dark knowledge reside on a powerful teacher model can significantly help us to improve the performance of the distilled model via understanding the underlying manifold of input data features. We conduct comprehensive empirical evaluation with different distillation configurations over multiple datasets, and the proposed method elaborate a consistent improvement in accuracy-speed trade-offs for distilled model.

Zeyi Tao is a fourth-year Ph.D. candidate in the Computer Science Department at William & Mary. Her research areas include machine learning optimization algorithm, the fast, efficient and secure network communication algorithms for distributed machine learning and transfer learning and model compression.

Magneto: Joint Motion Analysis Using an Electromagnet-Based Sensing Method

Presenter: Amanda Annette Watson
Co-Author: A. Lyubovsky
Advisor: Gang Zhou
William & Mary,
Computer Science

We created a body mounted electromagnet-based sensing system for joint motion analysis. Our system is wireless, portable, and unaffected by outside magnetic noise. Magnetic field readings are influenced by magnetic interference from the Earth's magneticfield, the environment, and nearby ferrous objects. To remove this magnetic interference, we present Magneto. Magneto uses the combination of an electromagnet and magnetometer to remove environmental interference from a magnetic field reading.We evaluated this method to show its performance when removing the interference in three movement dimensions, in six environments, and with six different cycling rates. Then, we localized the electromagnet with respect to the magnetic field reader. We evaluated our localization and see an average error of 3.43°in orientation angle 2.34% in distance. Knowing thelocalization allows us to apply Magneto to many different application scenarios including joint motion analysis. We evaluated this in two pilot studies: elbow angle and shoulder position. We accurately calculated elbow angles to the nearest 15° angles, 93.82% of the time. We calculated shoulder position in two-degrees of freedom with a 96.87% accuracy and in three-degrees off freedom with a 75.79% accuracy.

Amanda Watson is a Ph.D. candidate in the Computer Science Department at William & Mary, where she researches under Dr. Gang Zhou in the LENS lab. She received her M.S. in Computer Science from William & Mary and a B.A. in Computer Science and Mathematics from Drury University where she was a 4 year letterman on the varsity volleyball team. Her research interests include Wearable Technology for Healthcare and Athletic Performance.

FABA: An Algorithm for Fast Aggregation Against Byzantine Attacks in Distributed Neural Networks

Presenter: Qi Xia
Co-Authors: Z. Tao, Z. Hao
Advisor: Qun Li
William & Mary,
Computer Science

Many times, training a large scale deep learning neural network on a single machine becomes more and more difficult for a complex network model. Distributed training provides an efficient solution, but Byzantine attacks may occur on participating workers. They may be compromised or suffer from hardware failures. If they upload poisonous gradients, the training will become unstable or even converge to a saddle point. In this paper, we propose FABA, a Fast Aggregation algorithm against Byzantine Attacks, which removes the outliers in the uploaded gradients and obtains gradients that are close to the true gradients. We show the convergence of our algorithm. The experiments demonstrate that our algorithm can achieve similar performance to non-Byzantine case and higher efficiency as compared to previous algorithms.

Qi Xia is a fourth-year Ph.D. candidate in the Computer Science Department at William & Mary. His research areas include machine learning and deep learning, especially the security and privacy problems in deep learning. He holds a bachelor's degree in Statistics from the University of Science and Technology of China.

Accurate and Fast Estimation of Input-Dependent GPGPU Application Resilience

Presenter: Lishan Yang
Co-Authors: B. Nie, A. Jog
Advisor: Evgenia Smirni
William & Mary,
Computer Science

As Graphics Processing Units (GPUs) are becoming a de facto solution for accelerating a wide range of applications, its reliable operation is becoming increasingly important. One of the major challenges in the domain of GPU reliability is accurately measuring the GPGPU application error resilience. This challenge stems from the fact that a typical GPGPU application spawns a very large number of threads and then utilizes a large amount of potentially unreliable compute and memory resources available on the GPUs. Since the number of possible fault locations can be in the billions, evaluating every fault and examining its effect on the application error resilience is impractical. Even worse, the application error resilience is also input-dependent. In this work, for the first time, we deeply analyze the impact of different inputs on the application error resilience and show how analyzing a small fraction of input is sufficient to develop an accurate resilience model for a larger input. The key insight is based on the observation that error resilience is mostly determined by the mix of dynamic instructions rather than the data they process. Therefore, as long as the new input does not change the sequence of dynamic instructions, the application error resilience can be predicted accurately. In cases where different input affects the branch outcomes, only dynamic instruction profiling is required to estimate the new application error resilience. Overall, our new input-aware resilience estimation mechanism can reduce the overall sampling time by 57.6% while being highly accurate.

Lishan Yang is a fourth-year Ph.D. candidate in the Computer Science Department at William & Mary, under the supervision of Prof. Evgenia Smirni. Her research interest falls in GPU architecture, reliability analysis, and performance analysis. Before coming to William & Mary, she received her bachelor's degree in Computer Science from the University of Science and Technology of China in 2016.

DreamWalk: Fine-Grained, Brain-Controlled Virtual Reality Traversal

Presenter: Winson Ye
Advisor: Qun Li
William & Mary,
Computer Science

Virtual Reality (VR) has recently become more commonplace, but mass adoption is still a long way off. One crucial reason for this is because current VR experiences are largely static; movement in the virtual world is constrained by the limited real world physical space the player has. For example, state of the art VR environments cannot deliver high fidelity military training simulations because the user cannot traverse large landscapes in VR without eventually crashing into obstacles in the real world. Current motion control schemes either use a gamepad to move the virtual avatar, put up with no walking capability at all, or use specialized equipment like treadmills. Complicating factors like motion sickness also need to be considered. Ideally, walking in VR should be as natural as walking in the real world, but past work has been unable to accomplish this. To address this problem, I propose a real time brain computer interface, DreamWalk, that can directly translate brain signals from imagined walking into fine-grained control signals for a virtual avatar using an off-the-shelf dry EEG headset. In particular, DreamWalk can identify the user's intended gait by distinguishing between different patterns of brain activity in the motor cortex using deep learning. Successful completion of this research will pave the way for higher immersion in next-generation VR environments, thus putting us one step closer to mass adoption of VR.

Winson Ye is a first-year Ph.D. student in the Computer Science Department at William & Mary. He holds a B.S. Magna Cum Laude in Computer Science from the University of Connecticut. Broadly, he is interested in human computer interaction (HCI), VR/AR, applied machine learning, algorithms, and systems software development. He is currently developing novel HCI techniques for highly immersive VR environments, especially using brain computer interfaces.

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Jim Crow Education and the Formation of Racially Segregated Deaf Communities in Twentieth Century Virginia

Presenter: Grover Jasper Conner
Advisor: Melvin Ely
William & Mary,
History

In 2006, Chris Bell published an important article critically assessing the failures of scholars of disability to account for the experiences of African-Americans. A handful of scholars have earnestly taken up his challenge, but disability history, and the narrower sub-field of Deaf history, remains centered on the lives of white people. This paper problematizes the focus of scholars of Deaf history on a shared language and Deaf culture by demonstrating how white Deaf leaders and students fundamentally understood the Deaf community as white. By exploring the twentieth-century efforts by the Virginia Association of the Deaf (VAD) to improve the state's white school for the Deaf as well as the integration of that school in the 1960's, this paper demonstrates how segregationist racial ideology was not simply imposed by the state, but adopted by the VAD and the broader white Deaf community. The VAD not only excluded Black Deaf people from membership but further left the state's residential Deaf school for Black children out of its concerted campaign to improve Deaf education in Virginia. By examining the heretofore unexplored archives of the VAD and Virginia's segregated residential schools for the Deaf, this paper argues that centering race in the history of Deaf Americans undermines the dominant narrative of historians who have almost exclusively focused on Deaf exclusion from mainstream society. Despite the shared experiences that Deaf children of both races experienced, my research demonstrates that race served as a barrier to the formation of a single Deaf community.

G. Jasper Conner is a second-year Ph.D. student in the Lyon G. Tyler Department of History at William & Mary. His research explores twentieth century African-American history, with a particular focus on Black social movements. Jasper received his BA from Virginia Commonwealth University in African American Studies. His dissertation research explores the formation of Black Deaf community in the Jim Crow South.

"Unoccupied and of a Valuable Kind": The Georgia Gold Rush and Manufactured Cherokee Savagery

Presenter: Justin Estreicher
Advisor: Andrew Fisher
William & Mary,
History

Georgia's antebellum gold rush, beginning with the discovery of the yellow metal in the Cherokee Nation in the late 1820s, is often cited in passing by scholars as one of several factors contributing to Cherokee removal. As intruders streamed into Cherokee territory, the state and federal governments prevented Native mining by selectively enforcing prohibitions on digging and legally excluding Cherokees from the gold and land lotteries of 1832–33. While focused research on the Georgia gold rush as a whole is limited, the largely overlooked issue of Native mining activities requires particular attention. Considering Cherokee and non-Native commentary on the civilizational implications of officials' actions, this investigation highlights the rhetorical role of the gold rush in the process of removal. Euro-Americans made great efforts to justify removal by mischaracterizing the Cherokees as savage hunters who made poor use of land that they actually farmed in the fashion of southern planters. Actions against Cherokee mining, though, were more brazen than any measures to displace the Cherokees from their agricultural lands, suggesting that the novelty of mining as a potential mark of Native civilization created an opportunity for white officials to manufacture savagery—that is, to contrive a situation wherein an argument for a superior Euro-American right of occupancy could more credibly be made. The result was an enduring myth that the Cherokees had sat idly on precious mineral resources for centuries, never making effective use of them, as only a civilized people could.

Justin Estreicher is a first-year Ph.D. student in the History Department at William & Mary. His research focuses on interactions between white and Native American societies and representations of indigenous people, primarily in the nineteenth century. His recent projects have explored the impact of Georgia's antebellum gold rush on Cherokee removal and civilizational narratives applied to American Indians in public amusements around the turn of the twentieth century.

Reinscribing Memory in a Mausoleum: The Valley of the Fallen and the Polarized Political Landscape in Spain

Presenter: Tyler Jordan Goldberger
Advisor: Betsy Konefal
William & Mary,
History

On the one-year anniversary of the Republican defeat by the Nationalists in the Spanish Civil War, Dictator Francisco Franco declared that a memory site would be built to honor those who fell for "our Glorious Crusade." In the construction of this monument, known as the Valley of the Fallen, Franco privileged the memory of those who sacrificed their lives for a Nationalistic-Catholic Spain by inscribing symbolic meaning into the monument itself while actively erasing the narratives of Republicans. This monument became more nuanced once Franco was interred in the center of the Valley upon his death in 1975 alongside victims he had targeted during the war. Forty-four years after Franco's burial in the Valley in late October 2019, the Spanish government exhumed Franco's body and relocated his remains to a public cemetery. Even so, over 33,000 victims remain interred in the Valley privileging Nationalist memory, over 12,000 of whom remain unnamed and unidentified. This presentation will demonstrate the politicized nature of the Valley and how it interacted with national politics in order to remove Franco's body from a memory site that supports the Nationalist narrative over a more inclusive one. Through engaging with the contemporary news cycle in covering news related to the Valley, this paper will show the shift in public consciousness of this memory site and question whether the monument, after removing Franco's remains, still represents a skewed memory of the Spanish Civil War.

Tyler Goldberger is a first-year M.A./Ph.D. student in the History Department at William & Mary. His research focuses on the role of historical memory following dictatorships and human rights atrocities in the twentieth-century Spanish-speaking world. He holds a B.A. (History) from Duke University.

Get It Right: Women's Property Laws in Nineteenth-Century America

Presenter: Candace Gray
Advisor: Lawrence Peskin
Morgan State University,
History

Elizabeth Cady Stanton was wrong. The New York legislatures were not the genesis of woman's property laws in 1848. The Arkansas territory passed the first legislative act in 1835 to protect woman's property. In 1839, Mississippi state legislators, with little debate, passed a woman's property act into law. In 1840, the Republic of Texas added the women's property act to their constitution. My poster accurately displays the chronological place of the women's property law in the 19th century in the southern region of what is now the United States of America. My poster represents research for my dissertation in the 19th century Texas legal and social history of slavery, race, and women's rights. I trace the development of the property laws in America from the colonial era until the 20th century to exhibit the early American women's property laws significant to my argument that women's property laws and acts protected Anglo American women's "moveable property" – slaves. "Get it right" diagrams Angela Boswell's thesis that Texas and southern states created married women's property acts centered in debt and credit panics. Yet, historians continue to conjecture femme sole, and couverture tropes provided the protection. Finally, my graphic representation contributes to understanding the previously enslaved woman at the center of my dissertation, who, in 1873, in her defense in the Supreme Court of Texas will "claim it while she had a breath in her body."

Candace Gray is a Ph.D. candidate in the History and Geography Department at Morgan State University. Her work focuses on African Americans' legal status and gender in American South. She holds a B.A. from Mississippi University for Women and an M.A. in American History from George Mason University.

"Those Claiming the Rights of Free Men Are Themselves the Most Execrable of Tyrants"

Presenter: Bennett Edwin Herson-Roeser
Advisor: Joshua Piker
William & Mary,
History

Studies of Indigeneity are normally presented as separate from studies of race. This essay looks at the discourse of indigeneity together with race in the Northwest Territory from 1784 - 1818 and examines the overarching, oppositional construction of a "democratic peoplehood" of white settlers in the Territory that worked to both dispossess Natives from land and maintain a system of labor exploitation through Black slavery. This establishment of a democratic identity by white settlers ordered an apparatus of knowledge that served to contribute both to the marginalization of Natives and enslaved Blacks in the Territory. Whereas new scholarship has contested the anti-slavery legacy of the Northwest Ordinance, this essay seeks to demonstrate both how this contested legacy was contemporaneously experienced, while also connecting to newer scholarship of settler colonialism that looks at the nuances indigeneity involves relative to analytical understandings of race.

Bennett Herson-Roeser is a first-year M.A. student in the History Department at William & Mary. His research centers around the development of legal culture in the Northwest Territory (contemporary Midwest), particularly in relation to Indigenous and Racial identity. Currently, he is investigating petition culture in the Territory and the oppositional construction of identity and the importance of "democracy" involved in the discourse of his subjects.

The Development of Public Libraries in North Carolina, 1895-1941

Presenter: Robert M. Manzo
Advisor: Alexander Macaulay
Western Carolina University,
History

My research traces the development of public libraries in North Carolina from 1895, when citizens started organizing the state's first municipal public library, up to 1941, when the General Assembly approved regular state aid to municipal and county libraries. Free, tax-supported public libraries were a surprisingly late feature of the American republic. The first one in the nation opened in Boston in 1854 and the first ones in the South opened in 1893 and 1898, in Memphis, Tennessee and Durham, North Carolina, respectively. Why did the public library emerge so late in North Carolina, and indeed the South, compared to the Northeast and Midwest? What specific cultural, economic, and political conditions had to be met in order for libraries to be established? What were the barriers to library development, and how were those barriers overcome? After examining newspapers, state records, the writings of Southern leaders, and secondary sources, I found six major barriers to library development in North Carolina: strict legal limits on the authority of local governments, low population density, rural poverty, limited support for public education, racial segregation, and divisive regional sectionalism. Among the events that helped to ease these problems were the Southern Progressive movement, educational reforms, industrialists' philanthropic crusades, state and federal government expansion, and revolutions in transportation and communication. The state's public libraries developed under specific historical circumstances, and their development was neither easy nor removed from a range of cultural, political, and economic issues affecting society at large.

Robert Manzo is a second-year M.A. candidate in the History Department at Western Carolina University. His research interests include the history of the South, disability studies, and educational history. His Master's thesis topic is North Carolina library history. He holds a B.A. in History and an M.L.I.S. in Library and Information Studies.

The Role of Knowledge in Commodification: Salt Production in the Early Modern Dutch Atlantic

Presenter: Jennifer Ashley Motter
Advisor: Karin Wulf
William & Mary,
History

What is the role of knowledge in the production of a commodity? More specifically, what was the role of knowledge in the extraction, refinement, and trade of salt in Dutch Curaçao and Bonaire in the seventeenth century? To find this answer, I closely analyze the compiled and translated primary sources in The Curaçao Papers 1640-1665, housed at the New York State Archives, supplemented by correspondences between Dutch director-general Peter Stuyvesant and West India Company officials in Amsterdam. The commodification of salt was a long process, spanning outwards temporally and geographically. Fifteenth century Baltic trade in pickled herring gave the Dutch valuable experience working with and selling this resource, and once the Hapsburg monarchy closed off their Iberian saltpans to the Dutch in the late sixteenth century, Netherlanders were forced to cross the Atlantic for new sources. Using methods such as environmental history, and looking at the work of enslaved African laborers on the island, I argue that once in possession of the Caribbean islands of Curaçao and Bonaire, the Dutch utilized knowledge of the environment, salt refining, and global and market intelligence to transform this natural resource into a profitable commodity.

Jennifer Motter is a first-year M.A. student in the History Department at William & Mary. Her research interests include the Dutch in the early Modern period and Atlantic studies. She holds a B.A. in History from the University of Pittsburgh.

Mass Demonstrations: Catholic Ritual as Political Theater at the End of the Napoleonic Wars

Presenter: Mitchell Oxford
Advisor: Christopher Grasso
William & Mary,
History

When word of Napoleon's abdication reached the United States in summer 1814, the news held special significance for American Catholics. Not only did the French emperor's fall seem to mark the end of a generation of warfare, it also hearkened the release Pope Pius VII from five years' imprisonment. The faithful celebrated these auspicious events in unmistakably Catholic fashion: in churches across the country clergy pronounced an ancient hymn of thanksgiving called the Te Deum. These surprisingly ecumenical observances, and the ensuing reactions both favorable and hostile, highlight the enduring consequences of the French Revolution for Catholics in nineteenth-century America.

Mitchell Oxford is a Ph.D. candidate in the History Department at William & Mary. Oxford has broad interest in the study of religion in early America, and his research focuses on Roman Catholicism in the United States through the Civil War. His dissertation places the French Revolution at the center of emerging American Catholic institutions and identities in the early republic.

Labor in Colonial Virginia: How Women Tavernkeepers Typified Gendered "Professionalship," 1750-1795

Presenter: Chester Pelsang
Advisor: Meredith Lair
George Mason University,
History and Art History

This project examines the world of women tavern-keepers in colonial Williamsburg during the revolutionary era. Early historical works, such as Peter Thompson and David Conroy, study the political and economic spheres of taverns, while later works by Sharon Salinger and Sarah Meacham argue the importance of examining the social and material culture. A continual theme throughout tavern studies is the notion that women during this time lost power in the public sphere. The power of purchase and ability to obtain lines of credit were given only to white men, eliminating many opportunities for women to operate freely in the community. Yet, there are exceptions. An examination of the lives of Christiana Campbell and Jane Vobe complicates conventional understanding that women tavern-keepers worked under their husbands' names. I argue that these women were not only operating taverns as owner-proprietor, but they also conducted themselves as professionals. Meaning, they had substantial training, they moved geographically to pursue the same form of employment, and they engaged legally with the community. By sifting through family wills, land deeds, articles from the *Virginia Gazette*, and tavern inventory records, I discovered Campbell and Vobe moved their taverns, owned multiple establishments, and were deeded to the property under their own names. Viewing these women tavernkeepers as professionals allows labor historians who specialize in gender studies to examine a time thought to be void of female professionalship.

Chester Pelsang is a second-year M.A. History student in the Department of History and Art History at George Mason University. His research interests include transatlantic British-Caribbean and colonial-revolutionary America. Chester's current research explores tavern cultures of the larger Atlantic world during the age of British imperial power. Chester holds a B.A. in History and Religious Studies from Truman State University in Kirksville, Missouri.

The Name's the Same, but the Meaning's Not: Naming and Multiple Puritan Identities in Massachusetts's First Settler Families

Presenter: Kaila Knight Schwartz
Advisor: Karin Wulf
William & Mary,
History

Scholars have long argued that the unique Biblical character of early Anglo-American New England naming practices stemmed from the colony's puritan origins. However, examining the choices of puritan parents who named some children in England and others after migrating to New England calls into question the idea that certain names were more 'puritan' than others. Focusing on those multi-origin families who arrived with the first Anglo-American settlers of Plymouth and Massachusetts Bay shows the early stages of self- and community-fashioning, when their goal was creation, not 'acculturation,' to a new system as some have argued. The context of these families' backgrounds and experiences illustrates the role of contingency in their actions. In many cases, the naming record does not chart a linear progression from more to less stereotypically 'puritan,' a gentle reminder that families often balanced competing interests, that religiosity was subject to change over time, and that an individual name could convey more than one meaning. This possibility of multiple motivations guiding name selection fits with the arguments of more recent scholars of early New England religion who have asserted that 'the puritans' were neither members of a uniform monolith nor solely the product of a unique historical moment. Using John Winthrop's children as a case study, this paper argues that names alone cannot stand as an index of belief, forcing a reconsideration of how scholars can use collections of names as historical data when they know little else about their bearers.

Kaila Schwartz is a fourth-year Ph.D. candidate in the History Department at William & Mary. Her dissertation investigates the links between naming, memorialization, and personal and familial identity in New England from the beginnings of Anglo-American settlement through the nineteenth century. She holds a B.A. (History) from Brandeis University, an MA/MLS (History/Archives Management) from Simmons University, and an M.A. (History) from William & Mary.

Squaring the Circle:
Using Isotope to Radicalize Cuneiform Characters

Presenter: Eileen Jing Xing
Co-Author: M. Cammarosano
Advisor: David Wright
Brandeis University,
Near Eastern and Judaic Studies

Cultures of ancient Mesopotamia and Anatolia bequeathed an immense collection of written works, dutifully preserved in thousands upon thousands of clay tablets. The vast majority of tablets however are in a fragmentary state and the decipherment of their texts remains a daunting challenge. This project therefore makes use of an open source search and filter system (Isotope) in order to classify and then quickly find cuneiform characters. It takes inspiration from the JISHO database which has revolutionized the way new language learners identify Chinese/Japanese signs. As current cuneiform sign databases are based on stroke count and therefore require unknown signs to be complete, Squaring the Circle would be of use to students and researchs who are working to identify a fragmentary sign.

Eileen Xing is a Ph.D. candidate at Brandeis University studying the Bible and the Ancient Near East with a focus on Hittitology. Like Hittitologists of the past, her dream is discovering the lost city of Tarhuntassa, where the roads are paved with clay tablets instead of gold. She has a B.A. from University College London and an M.A. from the University of Wuerzburg.

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Stereoscopic Fast Camera Diagnostic Validation for Scrape-Off Layer Filament Statistics of the Mega-Ampere Spherical Tokamak

Presenter: Ryan Chaban
Co-Authors: T. Farley, N. Walkden, F. Militello
Advisor: Saskia Mordijck
William & Mary,
Physics

Fast (10kHz) Cameras paired with a tomographic inversion technique are used to investigate turbulent transport in the Scrape-Off Layer of the Mega-Ampere Spherical Tokamak (MAST). This technique uses the camera image, the magnetic geometry, and a manually created calibration to generate an emissivity map in the R-phi toroidal plane. Turbulent transport events known as “filaments” manifest as blobs on these maps which can be characterized by location, size, amplitude, and velocity. This technique has yielded results present in several papers published by the MAST team and has been numerically verified for a single camera using a synthetic diagnostic technique. This work seeks to experimentally validate the previous work by using data from two stereoscopic fast cameras and statistically comparing the distributions of filaments for each camera. We also present a method using a post-hoc shift and correlation to determine dissimilar frames which can be removed from the dataset to filter the statistical noise of the filaments to create a third, compound distribution with lower error.

Ryan Chaban is a third-year Ph.D. candidate in the Physics Department at William & Mary. His research area is Magnetic Confinement Nuclear Fusion. He has done research on the DIII-D tokamak in San Diego and is an active collaborator on the MAST tokamak in the United Kingdom where he is researching the 3D structures of the plasma exhaust.

Invertible Neural Networks: Generative Model for Markov Chain Monte Carlo Sampling of Lattice Field Theories

Presenter: Christopher Daniel Chamness
Advisor: Konstantinos Orginos
William & Mary,
Physics

By constructing a bijective map between two distinct distributions it is possible to quickly sample distributions that are not easily accessible. This is done by sampling a prior distribution of independent gaussian noise and following the mapping to the new distribution, representing physical variables. We show using an Invertible Neural Network (INN) to optimize the map allows enough flexibility to accomplish this task, where analytical methods cannot be used. The final distribution of the transformed variables is exact and tractable, which allows methods such as Metropolis-Hastings or reweighting to guarantee the exact target distribution is reached. Choosing a construction of the INN that is scales favorably with system size provides a path for future exploration of other problems that currently suffer from the inability to effectively sample, the so-called critical slowing down.

Christopher Chamness is a third-year Ph.D. candidate in the Physics Department at William & Mary. He has an interest in computational methods and models, specifically Machine Learning and Lattice QCD. His current research is focused on the development of Neural Networks for Physics Applications.

Quirks of QCD: Twist-2 Operators on the Lattice

Presenter: Tangereen Velveteen Bailey Claringbold
Advisor: Christopher Monahan
William & Mary,
Physics

The idea that matter is made of fundamental particles has been part of our scientific consciousness for millennia, from ancient Greek and Indian philosophers who predicted that all material is made of invisible and indivisible bits that combine to construct the world around us. In the 19th century, we discovered that molecules are made of atoms and, in the early 20th century, that atoms are made of electrons, protons, and neutrons. We now understand protons and neutrons to be composite particles, made of quarks and gluons. The theory that describes how quarks and gluons form protons and neutrons is Quantum Chromodynamics, or QCD. One of the challenges of QCD is that it can't analytically describe the proton, meaning that we must rely on numerical approximations, calculated on supercomputers. Unfortunately, many of QCD's useful techniques can't be used in numerical calculations, a problem that this project aims to address. Specifically, we wish to find a numerical formulation of the Twist-2 Operators, a set of mathematical tools that show up in calculations of Deep Inelastic Scattering, which is one of the main methods by which we investigate the structure of protons and neutrons.

Tangereen Velveteen Bailey Claringbold is a fourth-year Ph.D. candidate in the Physics Department at William & Mary. Their current research is in nuclear and hadronic theory. In 2016, they received their B.S. in Physics and Math from University of Portland and, in 2018, they earned their M.S. in Physics from William & Mary. They currently serve as a member of the Physics Department's Diversity Advisory Committee and the secretary of the Physics Graduate Student Association.

Transport Properties of Hybrid Junctions in Quantizing Magnetic Fields

Presenter: Joseph Jude Cuozzo
Advisor: Enrico Rossi
William & Mary,
Physics

We study the effects of a Zeeman field and valley splitting on Andreev processes and non-local transport across an NS junction with an applied out-of-plane quantizing magnetic field. In the presence of Zeeman splitting we calculate the proximity-induced pairing between spatially separated spin-polarized edge channels in the integer quantum Hall regime and find that the pairing is suppressed linearly in Zeeman splitting. We then find analytic expressions for Andreev reflection (AR) probabilities using an low-energy effective edge-state Hamiltonian within the Bogoliubov de-Gennes (BdG) formalism. We find that introducing a higher order, spin-dependent contribution to the renormalized drift velocity in the effective model is important to obtain qualitative agreement between theory and numerical results. We support our results with tight-binding calculations and explore the effect of a Zeeman field in the long-contact regime, where resonance signatures begin to dominate at large sub-gap excitation energies.

Joseph Cuozzo is a third-year Ph.D. candidate in the Physics Department at William & Mary. He is interested in modeling systems which can potentially host exotic non-Abelian excitations with applications in topological quantum computing. His research is focused on non-local superconducting correlations in hybrid junctions in the quantum Hall regime. He holds both a B.S. (Physics) and B.A. (Mathematics) from University of South Florida, and an M.S. (Physics) from William & Mary.

Enhanced Quantum Noise Suppression via Spatial Beam Optimization

Presenter: Savannah Cuozzo
Co-Authors: X. Hu, S. Thomas
Advisor: Eugeniy Mikhailov
William & Mary,
Physics

Precision measurements are limited by intrinsic noise due to quantum uncertainty. This noise appears in two different quadratures, called the phase and amplitude quadratures, and obeys the Heisenburg uncertainty principle, which sets the standard quantum limit (SQL). We can reduce noise in one of these quadratures (at the expense of increasing noise in the other). Light with noise suppression in one of the quadratures below the SQL is called squeezed light. Squeezed light yields significant improvement of signal-to-noise ratios in many applications including precision metrology and optical communication. We explore how the addition of spatial masks, applied with a spatial light modulator, improves the quantum noise suppression aided by Bayesian optimization algorithms. A spatial mask modifies two components of the beam profile: amplitude and phase. By modifying small portions of the applied mask, we optimize the beam's spatial profile to enhance the light-atom interaction and improve squeezing. In parallel with spatial beam optimization, we will present our work towards imaging the squeezed beam structure. We will show how we have developed methods that allow for spatial mode decomposition of the quantum beam. Spatial detection and control of squeezed beams is of particular interest to optical communication technologies since it would allow quantum information transfer on individual spatial modes.

Savannah Cuozzo is a third-year Ph.D. candidate in the Physics Department at William & Mary. She has a broad interest in optical physics, particularly where it can be applied in precision metrology. She is currently exploring how suppressing quantum noise can improve optical measurements.

Progress Towards an Ultracold Trapped Atom Interferometer

Presenter: Shuangli Du
Co-Authors: A. Rotunno, D. Beringer
Advisor: Seth Aubin
William & Mary,
Physics

Atom interferometers are extremely sensitive quantum measurement devices and are well suited for precision gravimetry. We present our progress in developing a new type of atom interferometer based on ultracold trapped atoms. The main benefit of a trapped atom interferometer is that, in principle, it can have a long phase integration time, which leads to a linear improvement in sensitivity over time. The development of our trapped atom interferometer requires several proof-of-principle milestones to be accomplished. Notably, we have already reached our first milestone: we have implemented a trapped atom clock with a coherence time in the 100 ms range. The trapped atom clock is similar to the trapped atom interferometer, but without spatial separation between the interferometer paths. Ultimately, our trapped atom interferometer will use two different spin states for the two paths, which we can spatially separate by applying a microwave-based spin-dependent force generated by the AC Zeeman effect. The next milestone is to apply a spin-specific energy shift to one of the interferometer paths, and characterize its effect and resulting coherence time. For the final milestone, we will convert this energy shift into a force that will spatially separate the two interferometer paths. Our proof-of-principle interferometer is a first step towards building a high precision gravimeter for remote detection of subterranean structures. Work supported by NSF and DTRA, and in part by VMEC.

Shuangli Du is a Ph.D. candidate in the Physics Department at William & Mary. His research is on ultracold atoms and atom interferometers.

Parton Distribution Functions from Lattice QCD

Presenter: Colin Egerer
Co-Authors: D. Richards, R. Sufian, J. Karpie, J. Qiu
Advisor: Konstantinos Orginos
William & Mary,
Physics

To the extent of astronomical observations, the bulk of the visible universe is comprised of bound states of quarks and gluons, of which the proton and neutron are familiar and pervasive examples. Quantum Chromodynamics (QCD) is the theoretical arena wherein the dynamics of hadronic states is encoded. Yet despite the apparent ubiquity, the strong coupling unique of QCD at low energies precludes approximate, or perturbative, calculations for the properties and internal dynamics of a hadron. Numerical solution of QCD, dubbed lattice QCD (LQCD), is the only known ab-initio method to quantitatively study low-energy QCD with controllable systematics. An essential ingredient required for a robust description of hadronic structure is that of Parton Distribution Functions (PDFs). PDFs are process-independent distributions that characterize the longitudinal momenta among the quark/gluon constituents of a fast-moving hadron, and facilitate interpretation of high-energy scattering data. Nevertheless, uncertainties in Higgs boson measurements and searches for physics beyond the Standard Model can be traced back to uncertainties in the non-perturbatively defined PDFs. This talk will expound upon the current paradigm of PDF calculations in LQCD, especially the formidable challenges faced when relating particular lattice calculable quantities to the physical PDFs and whether these relations are trustworthy. Results from two formalisms are highlighted, establishing the efficacy of the schemes and the necessity of such non-perturbative insight into hadronic structure afforded by LQCD.

Colin Egerer is a fifth-year Ph.D. candidate in the Physics Department at William & Mary. His research interests surround Quantum Chromodynamics (QCD), known otherwise as the strong nuclear force, and its numerical solution via Lattice QCD; more broadly, the dynamical generation of mass within the proton and neutron that is responsible for nearly all mass in the visible universe.

Near-field Infrared Spectroscopy of Heterogeneous Media

Presenter: Haoyue Jiang
Advisor: Mumtaz Qazilbash
William & Mary,
Physics

Scanning near-field optical microscopy (SNOM) is a novel technique for probing matter at the nanoscale. In traditional far-field optics, the spatial resolution is limited by the diffraction limit of light to approximately half of the wavelength. The wavelengths of infrared light are of the order of micrometers. SNOM allows for spatial resolutions which are bound only by the radius of curvature (~20 nm) of a tip of an Atomic Force Microscope (AFM). Hence, SNOM with infrared light allows nanometer scale spatial resolution much smaller than infrared wavelengths. This enables us to probe local properties of heterogeneous materials. Detailed modeling of the experimental spectra are required to extract the local infrared properties. Analytical models fail to accurately capture the experimental data. We report a fully numerical model to study broadband near-field infrared spectra measured in experiments. We will present results on two heterogeneous systems (insulating $SrTiO_3$ with metallic surface and Cu2S nanoplatelets on silicon). Insulating $SrTiO_3$ exhibits multiple surface phonon polaritons (SPhPs) in the infrared. Annealing $SrTiO_3$ forms a metallic surface layer that screens the SPhPs. Through our model, we will discuss how this screening effect provides insight into the properties of the metallic surface layer. We will next present experimental and numerical results on nanoplatelets of Cu2S grown on a silicon substrate, and our efforts to determine the intrinsic infrared properties of the Cu2S nanoplatelets.

Haoyue Jiang is a second-year Ph.D. candidate in the Physics Department at William & Mary. She is interested in infrared and optical spectroscopy, near -field microscopy and metal-insulator transitions.

π-π Scattering from Lattice Quantum Chromodynamics

Presenter: Chris Johnson
Advisor: Jozef Dudek
William & Mary,
Physics

We produce amplitudes of π-π elastic scattering from Lattice Quantum Chromodynamics (QCD) and discuss its analytic structure and its dependance on the pion mass. Lattice QCD has proven to be an invaluable tool for calculating the hadron spectrum from first principles QCD. The spectrum produced from the lattice calculation can be related to infinite volume physics by a mapping via Lüscher's method. This process is done first by performing a variational analysis of a matrix of correlation functions with suitable operators calculated from Lattice QCD. We examine the analytic structure of these amplitudes to understand intermediate scattering states. We perform the calculation at pion masses of approximately 239, 284, 329, 391 MeV on multiple volumes of anisotropic lattices at the lattice spacing $a_s \sim 0.12$fm.

Chris Johnson is a fifth-year Ph.D. candidate in the Physics Department at William & Mary. He is currently working in Lattice QCD, a computational approach to the theory of how quarks and gluons interact. In particular, he is interested in hadron spectroscopy which describes the masses and behavior of states that arise from QCD.

Emergent Properties in Films of Transition Metal Oxides

Presenter: David J. Lahneman
Advisor: Mumtaz Qazilbash
William & Mary,
Physics

Transition metal oxides exhibit diverse emergent phenomena such as strongly correlated Mott insulating states, magnetic and structural phase transitions, and metal-insulator transitions. Many of these emergent states occur at nanometer length scales which cannot be accessed with traditional infrared focusing methods due to the Abbe diffraction limit. However, scattering-type scanning near-field infrared microscopy (S-SNIM) can circumvent the Abbe diffraction limit and probe optical properties with spatial resolution of tens of nanometers. We have coupled table-top plasma light sources developed in -house to a commercial S-SNIM apparatus from Neaspec GmbH to demonstrate broadband infrared nano-spectroscopy. This is used to study the novel nanoscale properties of ultrathin vanadium dioxide (VO_2) film on rutile titanium dioxide (TiO_2) substrate. Due to strain from the substrate, the metal-insulator transition in the VO_2 film occurs at a temperature of 305 K which is much lower than in bulk VO_2. We also study the surface metallic layer induced by vacuum-annealing of insulating strontium titanate ($SrTiO_3$) crystals and extract the dynamical properties of the free charge carriers. M.M.Q. acknowledges support from ETRI and the National Science Foundation (NSF).

David Lahneman is a sixth-year Ph.D. candidate in the Physics Department at William & Mary. He graduated from Towson University with a B.S. in Applied Physics. His research focuses on optical studies of strongly correlated transition metal oxides.

Photocurrent Time Responses of VO_2 on TiO_2:Nb and Its Comparison to Ultrafast Photo Induced Insulator to Metal Transition

Presenter: Scott Madaras
Co-Authors: J. Creeden, D. Lahneman, M. Qazilbash, A. Lukaszew
Advisor: Irina Novikova
William & Mary,
Physics

We investigate the photocurrent time response along with the ultrafast insulator to metal transition (IMT) time response due to illumination by UV light on thin film vanadium dioxide (VO_2) grown on titanium dioxide (TiO_2) substrates doped with niobium for use in fast UV photodetectors. It has been shown that with the addition of the dopant Nb to the substrate of TiO_2, a heterojunction is formed between the VO_2 and the TiO_2:Nb, which gives an advantageous band structure for generation of high external quantum efficiency photocurrent. VO_2 is a highly correlated material that has an IMT. This IMT is fast, on the order of 100s of fs to ps when pumped and probed with ultrashort light pulses(150fs) with recovery times of 10s to 100s of ns. It has been seen that the photocurrent generation of this system has time constants of 100s of μs for turn on and ms for turn off. We will explore possible reasons of why the photocurrent time constants are slower when compared to the ultrafast probed IMT of VO_2 with the IMT being an upper limit of the speed of the photocurrent generation.

Scott Madaras is a sixth-year Ph.D. candidate in the Physics Department at William & Mary. His research area includes experimental testing and modeling of condensed matter, studying the behaviors of strongly correlated materials such as the transition metal oxide, vanadium dioxide. He uses optical techniques such as surface plasmon generation and ultrafast laser time resolved pump probe testing to explore vanadium dioxide behaviors.

Surface Phonon-Polaritons in Isotropic and Anisotropic Media

Presenter: Patrick McArdle
Advisor: Mumtaz Qazilbash
William & Mary,
Physics

Scattering-type scanning near-field infrared microscopy is fast emerging as a valuable experimental probe of nanomaterials. Light-matter interactions in polaritonic materials at nanometer length scales can be probed effectively with this experimental technique. When there is strong coupling of light to the probe-sample system in highly polar materials such as insulating $SrTiO_3$, the phonon-polariton resonances should be described by detailed numerical simulations. I will present the modeling of broadband near-field infrared spectra of surface phonon-polaritons (SPhPs) in various isotropic systems (SiO_2, $SrTiO_3$, SixNy). I will also present the first numerical model of an absolute near-field scattering measurement on the SPhP of SiO_2. In addition, nano-imaging of SPhP propagation along a sample's surface will be discussed. Lastly, I will present results on rutile TiO_2, a material which has an anisotropic dielectric function. The match between experimental results and our models establishes the efficacy of detailed numerical simulations for explaining and analyzing experimental spectra.

Patrick McArdle is a Ph.D. candidate in the Physics Department at William & Mary. Patrick is a senior graduate student in the photon spectroscopy lab under advisor Dr. Qazilbash.

Dark Matter Constraints on the Inert Three Higgs Doublet

Presenter: Marco Antonio Merchand
Advisor: Marc Sher
William & Mary,
Physics

In this work we study a three Higgs doublet model where one doublet is inert and the other two doublets are active. Flavor changing neutral currents are avoided at tree-level by imposing a softly broken parity symmetry and we consider type I and type II Yukawa structures. The lightest inert scalar is a viable Dark Matter (DM) candidate. A numerical scan of the free parameters is performed taking into account theoretical constraints such as positivity of the scalar potential and unitarity of 2->2 scattering amplitudes. The model is further constrained by experimental results such as B physics lower limits on charged Higgs masses, Electroweak Precision Observables, LEP II, LHC Higgs measurements, Planck measurement of the DM relic abundance and WIMP direct searches by the LUX and XENON1T experiments. The model predictions for mono-jet, mono Z and mono Higgs final states are studied and tested against current LHC data and we find the model to be allowed. Projected sensitivities of direct detection experiments will leave only a tiny window in the DM mass versus coupling plane that is compliant with relic density bounds.

Marco Merchand is a sixth-year Ph.D. candidate in the Physics Department at William & Mary. His research is in the area of high energy particle physics with focus on Higgs phenomenology and beyond the Standard Model physics. His current interests include cosmological phase transitions in the early universe, baryogenesis and gravitational waves.

Two-Body Matrix Elements for Arbitrary Spin Particles

Presenter: Felipe Gilberto Ortega-Gama
Co-Author: A. Jackura
Advisor: Jozef Dudek
William & Mary,
Physics

In recent years, the numerical calculations of physical observables directly from the fundamental theory of the strong nuclear force, i.e. QCD, have matured enough to describe states of a single particle. This numerical technique is called Lattice QCD (LQCD), since it simulates three-dimensional space in a finite lattice. Currently, the mass of the nucleons and other subatomic particles can be reliably extracted from LQCD, as it can be accurately matched to experimental observations. Similarly, their response to external probes, known as form factors, is underway to accomplish similar levels of accuracy. However, the extraction of multi-body observables turns out to be more challenging, since there is no direct analogue between two-body states in a finite lattice, and asymptotic two-body states in an infinite-sized universe. In this talk I describe the progress towards a formalism that relates the lattice matrix elements of two-body states composed of particles with arbitrary spin, with the form factors of two-body asymptotic states. Once the necessary numerical calculations are carried out, this formalism will allow us to characterize the structure of strong resonant and bound states.

Felipe Ortega-Gama is a second-year Ph.D. candidate in the Physics Department at William & Mary. His research currently focuses on the study of subatomic systems through numerical tools. Currently he is working on the characterization of resonant and bound two-particle states. He earned a M.Sc. from the University of Waterloo in Canada as part of the Perimeter Scholars International program. He holds a B.Sc. in Engineering Physics from the Tec de Monterrey in Mexico.

Neutron Skins of Heavy Nuclei

Presenter: Victoria Owen
Advisor: David Armstrong
William & Mary,
Physics

In heavy nuclei, an excess of neutrons leads to a larger charge distribution than that of the protons, forming what is called a neutron skin. The precise thickness of this skin has implications from nuclear equations of states to the size of neutron stars. The elastic scattering Lead and Calcium Radius Experiments at Jefferson Lab have the unique ability to measure some such nuclear distributions in a precise, model independent way. The theory behind these precision measurements and their physics implications will be discussed.

Victoria Owen is a fifth-year Ph.D. candidate in the Physics Department at William & Mary. She specializes in parity-violating experimental nuclear physics happening at Jefferson Lab and is currently participating in efforts to run an ongoing experiment

Application of Quantum Correlated Twin-Beams to Enhance Optical Communications

Presenter: Nikunjkumar Prajapati
Co-Authors: S. Cuozzo, L. Cohen,
E. Siddiqui, J. Dowling
Advisor: Irina Novikova
William & Mary,
Physics

All measurements performed using lasers have a fundamental limit on their ultimate sensitivity, set by the unavoidable quantum noise present in even a perfect laser field. We look to explore the application of quantum correlated twin beams to achieve accuracy better than this limit. Quantum correlated beams, while individually noisy, share both temporal and spatial fluctuations beyond that classical limit. Thus, when one takes a differential measurement of correlated beams, it results in lower noise than if ordinary laser beams were used. This allows us to exploit this quantum effect to enhance measurement sensitivity and increase precision. We utilize a non-linear process in rubidium atoms called four wave mixing (FWM) to generate the quantum twin beams. In this process, the interaction of a strong pumping optical field with hot Rb vapor results in the amplification of a seeded probe beam and the corresponding generation of correlated conjugate photons in a pairwise fashion. This leads to the non-classical correlations in their intensity fluctuations and to the reduced noise for the differential measurement of the two beams. We have used such quantum beams in quantum interferometers to improve phase sensitivity and as an entangled beam source for secure quantum communications. Currently, we are using the beams for quantum imaging, that will have a broad range of applications in the sciences due to its versatility. For example, by using images to carry information, we can significantly enhance the bandwidth of the signal being sent; by mapping correlations on a camera, we can possibly use it to enhance the imaging of weakly absorbing samples and other applications.

Prajapati is a fifth-year Ph.D. candidate in the Physics Department at William & Mary. His research interests include quantum information technologies. His recent work has addressed the shape manipulation of light, optical quantum memory, and quantum interferometers with enhanced sensitivities. He is currently working on trying to map the spatial quantum correlations present in quantum beams of light.

SOLPS Study of the Roles of Fueling and Plasma Transport on Setting the Density Pedestal in High Opacity Experiments on C-Mod

Presenter: Richard M. Reksoatmodjo
Co-Authors: J. Hughes, J. Lore, X. Bonnin
Advisor: Saskia Mordijck
William & Mary,
Physics

The success of magnetic-confinement fusion energy reactors relies on the formation of a density pedestal at the boundary edge of the confined plasma. Formation of this density pedestal is found to be unaffected by scrape-off layer (SOL) opacity to neutral particles in experiments performed on the Alcator C-Mod tokamak at the MIT Plasma Science and Fusion Center. To assess the relative role of fueling versus transport in setting the pedestal, we use the SOLPS-ITER code suite to calculate neutral density profiles for both a high current/opacity discharge and a lower current one. Simulated electron density and temperature profiles are matched to experiment by varying transport coefficients in the code, revealing neutral densities an order of magnitude lower in the high vs low current discharge. To achieve greater fidelity with experiment, a ballooning transport model is first implemented to better approximate expected poloidal asymmetries in plasma transport around the machine. This causes neutrals to be redistributed, increasing in regions where transport increases, and decreasing where transport decreases. Neutral gas puffs are introduced in the model for both discharges to further probe transport dynamics across the SOL, as done in experiment. These cause simulation temperatures to decrease as expected, but also cause the density pedestal to increase, an effect unobserved in experiment. Particle drifts are lastly turned on in the SOLPS model, to investigate the effect of drifts on neutral densities in an attempt to reconcile the difference between model and experiment.

Richard Reksoatmodjo is a third-year Ph.D. candidate in the Physics Department of William & Mary. His active area of research concerns the computational modeling of fusion plasmas, focused specifically on the transport and turbulence phenomena that occur in the boundary edge region of such plasmas.

Progress Towards Spin-Dependent Radio Frequency Trapping for Ultracold Atoms

Presenter: Andrew Peter Rotunno
Co-Authors: S. Du, D. Beringer
Advisor: Seth Aubin
William & Mary,
Physics

We report on theoretical and experimental progress in the development of spin-dependent traps based on radio frequency (RF) near-field potentials using the AC Zeeman (ACZ) effect. The ability to trap and control atoms based on their internal spin state has applications in high-precision atom interferometers, qubit logic gates in quantum computing, novel many -body systems, and new methods of sympathetic evaporative cooling for cold atoms. In recent work, we have shown the ability to push or pull individual atomic spin states using RF magnetic fields with high gradients near an atom chip with a single RF current of a few MHz. With the addition of multiple RF currents on the atom chip, including controlled relative phase and amplitude, spatial trapping of atoms in specific spin states should be possible. Simulations show that two Watts of power in three chip wires can produce a trap depth of 60-80 ?K. Different trapping schemes employ a ground plane, multiple chip wires, RF frequencies, and combinations of amplitude and phase parameters to control trap geometry while targeting specific spin states. We also report on progress towards apparatus upgrades to implement this new trapping method, as well as preliminary tests of state mixing during long hold times as a function of detuning and applied power. This work is supported by DTRA and NSF, and in part by VMEC.

Andrew Rotunno is a sixth-year Ph.D. candidate in the Physics Department of William & Mary. His research focuses on applications of the AC Zeeman effect on ultracold atoms. He enjoys volunteering with a local indoor microgreens garden, and is the proud owner of three rabbits.

Understanding Beam Current Monitor Double Differences and Minimizing Noise that Leads to False Asymmetries

Presenter: Ezekiel Wertz
Advisor: David Armstrong
William & Mary,
Physics

The Lead Radius Experiment (PREX-II) at Jefferson Lab measured the parity-violating electroweak asymmetry in elastic scattering of longitudinally polarized electrons from lead-208 and from that measurement can extract the radius of the neutron skin of lead-208. Since this experiment requires high precision, it is important to understand and correct for sources of false asymmetries. One possible false asymmetry is the inherent noise from a beam current monitor (BCM), an apparatus that measures the current of the electron beam. Understanding this particular false asymmetry is important because corrections to the measured asymmetry rely on normalizing to the beam current. To minimize the effects of this type of false asymmetry multiple pairs of BCMs can be compared in a 'double difference' calculation of the measured asymmetry to evaluate the precision at which the two different BCMs measure the beam relative to each other. By considering these double differences, one can determine which pair of BCMs is the least noisy and therefore contributes the smallest false asymmetry. The analysis of BCM double differences will be discussed.

Ezekiel Wertz is a second-year Ph.D. student in the Physics Department at William & Mary. His research interests include experimental nuclear and particle physics. He holds a B.Sc. in Physics from Lebanon Valley College.

Constraint of the MINERvA Neutrino Flux Using Neutrino-Electron Elastic Scattering

Presenter: Luis Alberto Zazueta Reyes
Advisor: Michael Kordosky
William & Mary,
Physics

Neutrinos are the most abundant particles in the universe but also the strangest. They come in a family of three types, they hardly interact with matter, and they have tiny masses compared to the other particles. While neutrinos travel through space they transform back and forth between their different types, a phenomenon called neutrino oscillation. By studying neutrino oscillation we hope to answer fundamental questions about the nature of the Universe. For example, why is there more matter than antimatter? Experiments study neutrino oscillation using two detectors located hundreds of kilometers apart. The detectors count the number of neutrinos interacting inside of them. They also infer each neutrino's energy and the total number of neutrinos passing through the detector. To do that, the experiments need to know how likely it is for a neutrino to interact with a nucleus, a quantity called the cross-section. But, determining neutrino-nucleus cross-sections requires a neutrino source with a well-understood flux -- that is the number of neutrinos per area per time, as well as the energy distribution of those neutrinos. We have precisely determined the flux of the NuMI neutrino beam using the MINERvA detector at Fermilab. My poster will describe the experimental method, the results, and our prospects for future experiments. This work is presented on behalf of the MINERvA collaboration.

Luis Zazueta is a fourth-year Ph.D. candidate in the Physics Department at William & Mary. His work on high energy physics specializes in neutrinos, with participation in the MINERvA experiment at Fermilab and ProtoDUNE at CERN.

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Sentencing Decisions of Accused Offenders: Interracial Contact, Criminality Stereotypes, and Racial Bias

Presenter: Annabelle Bass
Advisor: Cheryl Dickter
William & Mary,
Psychological Sciences

One way to reduce the learned stereotypes that result from biased media coverage is interracial contact, which produces positive effects when individuals of different races interact in an environment that is non-competitive and is conducive to sharing cultural information (Allport, 1954; Mancini, Mears, Stewart, Beaver, & Pickett, 2015; Tropp & Barlow, 2018). Research has shown that a racialization of crime effect exists, in which media reporting of crimes is biased towards covering crimes that are violent and involve a person of color, leading to Blacks being depicted as a "prototype" for crime (Eberhardt, Goff, Purdie, & Davies, 2004; Gilliam & Iyengar, 2000; Mancini et al., 2015). It is the purpose of this study to address the relationship between racial stereotypes of criminality and the effects of intergroup contact, in regards to perceptions of sentencing decisions in the judicial system. Study participants will be drawn from a national online sample (expected n=100) of White Americans, ages 18+. To examine Whites' perceptions of criminality and racial bias, as well as judgements of sentencing decisions, participants will view fictitious criminal case records (White, Black, and race-unspecified criminal offenders), and complete measures of interracial contact. We expect that those who have had less interracial contact will make more negative sentencing decisions of racial outgroup members. This work can add to our understanding of how interracial contact can impact the sentencing decisions of accused offenders.

Annabelle Bass is a first-year M.S. student in the Psychological Sciences Department at William & Mary. She holds a B.A. in Psychological Science and Criminology from Central Connecticut State University. Her research interests broadly include social justice and diversity issues, as applied to the criminal justice system. Specific interests include research topics concerning intergroup contact as well as bias and prejudice.

Exploring Predictors of Reactions to Disrespectful Encounters

Presenter: Amanda Nichole Chappell
Co-Author: J. Steele
Advisor: JoNell Strough
West Virginia University,
Psychology

Disrespect involves having low regard or low esteem for someone or something. Disrespect is a universal experience and has the potential to negatively impact relationships (Hawkins, 2015). Disrespect is typically associated with negative outcomes, like aggression and hostility (Shwalb & Shwalb, 2006). Currently, there is a lack of literature on emotional responses to being disrespected, especially in older adulthood. The current study examined individual characteristics that predict reactions to being disrespected. Younger (ages 19-25) and older adults (ages 50-77) imagined that a person they knew had disrespected them in six different hypothetical situations. For each situation, participants rated their sensitivity to disrespect and their emotional reactivity. Age, gender, personality traits (openness, conscientiousness, extraversion, agreeableness, neuroticism), and social rejection were entered in simple linear regressions that predicted people's sensitivity and emotional response to being disrespected. Social rejection (being ignored by a person/group; feeling like one does not belong in a group) was the only significant predictor. People who felt more socially rejected reported greater sensitivity to disrespect and had stronger emotional responses ($p<.001$). Disrespect is relevant for virtually all settings, and there is a need for studying disrespect, especially in today's social climate.

Amanda Chappell is a first-year Ph.D. student in the Lifespan Developmental Psychology program at West Virginia University. She received her B.S. in Psychology at Longwood University, and her M.A. in Experimental Psychology at Radford University. She currently researches emotion regulation, emotion socialization, disrespect, and parenting.

Anxiety's Effect on Emotional Reactivity in a School Population

Presenter: Kimberly Elliott
Co-Authors: A. Gonzalez, A. Miranda
Advisor: Brenda Rich
The Catholic University of America,
Psychological Sciences

Children with anxiety are characterized by emotional reactivity: greater frequency and intensity of negative emotional responses (Carthy et al., 2010; Morgan et al., 2013). Those with higher anxiety and depression symptoms tend to down-regulate positive emotions, which is associated with increased risk of anxiety (Carl et al., 2014). This study aimed to clarify the relationship between anxiety and emotional reactivity while controlling for depression. 143 children, (M=10.25± .55 years) participated in the Resilience Builder Program® (RBP), a 12-week manualized group therapy for children with social deficits that aims to improve emotion regulation, adaptability, and social deficits, in schools. Children completed the Behavior Assessment System for Children (BASC-2; Reynolds & Kamphaus, 2004) and the Resiliency Scale for Children and Adolescents (RSCA; Prince-Embury, 2007). When controlling for depression, children's anxiety significantly predicted emotional reactivity, ?R2=.18, F(2, 139) =43.29, p<.001, along with the subscales of sensitivity, ?R2=.19, F(2, 140)=43.34, p<.001, recovery, ?R2=.06, F(2, 139)=9.97, p=.002, impairment, ?R2 =.15,F(2, 139)=32.57,p< .001. Children exhibited higher emotional reactivity with heightened anxiety. Heightened anxiety increases higher sensitivity (higher intensity and lower threshold), difficulty to recover (ability to bounce back) and larger impairment (inability to function other than being upset). Results indicate that therapies that help anxious children regulate their emotional reactivity may best improve social skills and academics.

Kimberly Elliott is a second-year student in the M.A. in Psychological Science program at the Catholic University of America. Her research areas include children with attention deficit hyperactivity disorder and autism, social skills, and therapy effectiveness. She is currently investigating the impact of motivation on a child's social skills and their therapy outcomes.

Pathogen Prevalence as a Predictor of Interracial Marriage

Presenter: Jason D. Freeman
Advisor: Joanna Schug
William & Mary,
Psychological Sciences

Building on previous research in evolutionary biology, recent literature has sought to explain intergroup relations through the lens of historical pathogen prevalence (Schaller & Duncan, 2007). This study seeks to expand on recent findings showing that the presence of pathogens in a social environment is associated with increased levels of prejudice and xenophobia (O'Shea et al., 2019; Faulkner et al., 2004). We hypothesized that pathogen prevalence would negatively correlate with the prevalence of interracial marriages within a given state. To test this, intermarriage rates for each US state were compiled using statistics available from Pew Research (Wang, 2015). To control for demographic makeup of a given state, expected intermarriage rates were calculated and then subtracted from the observed intermarriage rate. When these adjusted intermarriage scores were compared with Fincher & Thornhill's (2004) Parasite Stress USA measure of pathogen prevalence, a significant negative correlation was found ($r = -0.38$, $p = 0.006$). This indicates that, as expected, individuals in states with higher pathogen prevalence are significantly less likely to marry outside their race. These results provide further support for the pathogen prevalence hypothesis of prejudice and out-group bias. Further, this is the first evidence that pathogen levels may influence race-based preferences in partner selection.

Jason Freeman is a first-year M.S. candidate in the Psychological Sciences Department at William & Mary. He has a broad interest in cultural and evolutionary psychology, particularly social ecology and the effects of environmental pathogen prevalence. He holds an M.L.A. with certificates in Social Neuroscience (SCAN) and Healthcare Innovation from the University of Pennsylvania, as well as a B.A. in Psychology and Political Science from Rutgers University.

The Role of Protective Behavioral Strategies in the Relationship Between Personality and Negative Marijuana Outcomes

Presenter: Luke Herchenroeder
Advisor: Adrian Bravo
William & Mary,
Psychological Sciences

The present study examined whether the Big Five personality traits (openness, conscientiousness, extraversion, agreeableness, and emotional stability) relate to marijuana outcomes (use frequency and negative consequences) via use of protective behavioral strategies (PBS) in a large sample of college student marijuana users. Participants were 1175 college students who used marijuana in the last 30 days. The majority of students identified as being female (63.3%) and reported a mean age of 20.96 (Median=20; SD=3.95) years. Participants completed questionnaires assessing frequency of marijuana use, negative consequences of marijuana use, PBS use, and personality traits. Results indicate that PBS use mediated the associations between personality traits and marijuana consequences, such that higher conscientiousness, extraversion, and agreeableness were associated with more PBS use; which in turn was associated with lower frequency of marijuana use, which in turn was associated with less marijuana consequences. Conversely, higher emotional stability was associated with lower PBS use; which in turn was associated with higher frequency of marijuana use, which in turn was associated with more marijuana consequences. Our findings suggest that examining the usage of PBS is crucial to understanding the relationship between personality traits and marijuana use outcomes.

Luke Herchenroeder is a first-year M.S. student in the Psychological Sciences Department at William & Mary. His research areas include social and personality psychology with a focus on health behaviors. He holds a B.A. from the University of Redlands.

Externalizing Behaviors in Children with Incarcerated Parents

Presenter: Daryl Rosenblum Hesse
Advisor: Danielle Dallaire
William & Mary,
Psychological Sciences

Research has found that children with an incarcerated parent are at greater risk for externalizing behaviors (e.g., Kjellstrand & Eddy, 2011). Children's externalizing behaviors are associated with poorer family functioning (Donenberg & Baker, 1992), academic achievement (Breslau, Breslau, Miller, & Raykov, 2010), and delinquency (Fergusson & Horwood, 1995). To our knowledge, longitudinal studies that have examined these externalizing behaviors in children with incarcerated parents have only evaluated the influence of parental incarceration in the first 10 years of children's lives on subsequent externalizing behaviors in adolescence (e.g., Murray & Farrington). The goal of the present study is to model externalizing behaviors longitudinally, including in the model the status of parents' incarceration at each time point. We are using data from the NICHD SECCYD, which is a multi-site, national study completed in four phases, starting with infancy and concluding in adolescence. We will utilize latent growth curve analyses (LGCA) to observe individuals' developmental trajectories, which will allow us to describe differences in individual slopes and intercepts. We will also be able to evaluate group trajectories. We expect that parental incarceration will be associated with greater externalizing behaviors, and these differences will be seen individually and for groups.

Daryl Rosenblum Hesse is a second-year M.S. candidate in the Psychological Sciences Department at William & Mary. She holds a B.A. in Psychology from the University of Notre Dame, where she studied infants' socio-emotional development. Daryl joined the Healthy Beginnings Lab in the fall of 2018, where she studies developmental outcomes for children with incarcerated parents.

Psychological Distress, Mindfulness, and Emotional Eating

Presenter: Ti Hsu
Advisor: Catherine Forestell
William & Mary,
Psychological Sciences

Eating in response to negative emotions occurs due to an individual's lack of awareness and consequent inability to distinguish between physiological hunger and psychological distress. This lack of awareness is the antithesis of mindfulness, a non-judgmental state of awareness of, and attention to, the present moment. Only one other study to date (Pidgeon, Lacota & Champion, 2013) has examined the role of mindfulness in the association between psychological distress and emotional eating. However, it utilized the Mindfulness Awareness Attention Scale, which fails to capture the multidimensional nature of mindfulness. We conducted a replication and extension of this study with the Five Factor Mindfulness Questionnaire to probe the effects of specific facets of mindfulness on the relationship between anxiety and depression symptoms and emotional eating. Results indicate that non-judging of inner experience and the description of experiences significantly moderate the relationship between depression and anxiety and emotional eating, such that those who are less non-judgmental engage in emotional eating even at low levels of depression and anxiety, and those who are more non-judgmental are more vulnerable to emotional eating as depression and anxiety increase. Those low in describing their experiences engage in emotional eating even at low levels of anxiety, and those high in describing are more vulnerable to emotional eating as anxiety increases. These findings have implications for the implementation of mindfulness-based interventions for disordered eating.

Ti Hsu is a second-year M.S. candidate in the Psychological Sciences Department at William & Mary. Her research is focused on focused on how stressful experiences contribute to risk for emotional disorders and how evidence-based interventions mitigate this risk. Her thesis explores the effect of mindfulness both as a trait and state on the relationship between depression and anxiety symptomatology and emotional eating.

Non-Social vs. Social Jobs: Employment Biases Towards Autistic Individuals

Presenter: Bendu M. Jackson
Advisors: Cheryl Dickter and Josh Burk
William & Mary,
Psychological Sciences

Despite the pervasiveness of autism (1 in 68), implicit and explicit attitudes towards people with ASD are mainly adverse (Cage et al., 2019). Although in recent years more research has been conducted to investigate implicit attitudes towards other mental illnesses (Teachman, Wilson, & Komorovskaya, 2006) and physical disabilities (Nosek et al. 2007), few studies have assessed implicit and explicit attitudes toward adults with autism. Our study aims to examine implicit and explicit attitudes toward autistic individuals who are seeking employment. A two-way ANOVA will be used to analyze the data to determine if there are interactions between (ASD x Non-ASD) (Social Job x Non-Social Job). A multiple regression will also be conducted with only the ASD conditions, to determine the relationships between the ASD conditions and the likelihood of being hired. We want to replicate a previous study conducted in our lab, which found that participants had negative implicit attitudes but reported positive explicit attitudes towards autistic individuals (Lipson, Taylor, Dickter, & Burk, 2019). We expect to find that participants will be more likely to hire Non-ASD individuals than ASD individuals, employers will prefer Non-ASD individuals for social positions, but there will not be a significant difference for the non-social position, and negative implicit attitudes will predict hiring decisions towards ASD individuals. A possible implication for our study is to better integrate autistic individuals into different employment spaces.

Bendu Jackson is a second-year M.S. Experimental Psychology candidate in the Psychological Sciences Department at William & Mary. Her research interests include minority well-being, emotional disorders, first-generation college students, and autism. Her thesis topic is implicit and explicit biases towards autistic individuals.

Investigation of the Relational Mobility Scale's Predictive Utility and Validity

Presenter: Caroline Jordan
Advisor: Joanna Schug
William & Mary,
Psychological Sciences

Relational mobility is the degree to which individuals may voluntarily form and terminate relationships in a given society (Schug et al., 2009). Previous research has found evidence that this theory can explain cross-cultural differences in behavior and cognition (Schug, Yuki, Horikawa, & Takemura, 2009; Schug, Yuki, & Maddux, 2010). There is evidence of the relational mobility scale's convergent validity with metrics such as retrospective reports of new acquaintances encountered (Thomson et al., 2018). However, questions remain regarding whether the theory of relational mobility is best measured through assessing personal options and choices regarding associations, or one's perception of other people's freedom to leave and form relationships. In this study, we examine data from multiple self-report studies collected in both the United States and Japan. We model the predictive utility of relational and personal mobility (via the relational mobility and personal mobility scales) on interpersonal outcomes such as trust and number of new acquaintances met. We expect to contribute to the research regarding the measurement of relational mobility as it relates to both individual and societal outcomes.

Caroline Jordan is a second-year M.S. candidate in Psychological Sciences Department at William & Mary. She has a B.A. in Psychology from the University of Virginia. Her research interests include organizational behavior and cross-cultural psychology.

Does Absorption Predict Responses to Mental Health Interventions?

Presenter: Joshua Lipson
Advisor: Joshua Burk
William & Mary,
Psychological Sciences

Psychotherapeutic and pharmacotherapeutic interventions believed by many clinicians and patients to be effective often show limited effects when held under the lens of scientific scrutiny. Rather than discrediting the reported benefits of these interventions, in certain cases, the research has demonstrated something more subtle: some therapies work well for some patients but not at all for others, averaging out to meager effect sizes. For my master's thesis, I plan to focus on one particular personality trait that may be predictive of individual response to a wide range of therapeutic interventions: absorption, broadly defined as "an individual's cognitive capacity for involvement in sensory and imaginative experiences in ways that alter an individual's perception, memory, and mood". Absent trained psychotherapeutic personnel and a large clinical population, this hypothesis will be tested by conducting a mindfulness meditation-based intervention to reduce social anxiety symptoms (a well-validated paradigm), with the goal of testing whether trait-level absorption is a significant predictor of response magnitude. For our first study, an omnibus exploration of absorption's trait-level correlates in the general population, we found absorption to be positively associated with trait-level openness to experience, anxiety, and rumination, but unrelated to autistic traits or trait-level mindfulness. Our second, experimental study is currently underway.

Josh Lipson is a second-year M.S. candidate in the Department of Psychological Sciences at William & Mary. His master's thesis topic focuses on trait absorption as a predictor of individual responses to a mindfulness-based social anxiety intervention. He holds an A.B. in Near Eastern Languages and Civilizations from Harvard.

Approach and Avoidance Behaviors Toward Food in Neophobic Children

Presenter: Christina Sophia Marlow
Advisor: Catherine Forestell
William & Mary,
Psychological Sciences

Food neophobia, defined as an unwillingness to try novel foods (Pliner & Hobden, 1992), is related to a lower consumption of fruits and vegetables in children (Cooke, Carnell, & Wardle, 2006). Factor analyses of the Food Neophobia Scale have found two related factors, one consisting of items associated with approach motives and another consisting of items associated with avoidance motives (Nezlek & Forestell, 2018). Conceptualizing acceptance of novel foods as a combination of independent but related motives could provide insights into effectively addressing neophobic children's dietary challenges. The current study aims to address the degree to which neophobic children approach or avoid foods. Eighty children aged seven to ten years old will complete an implicit approach-avoidance reaction time task. This task evaluates automatic behavioral avoidance and approach tendencies. Food stimuli will include familiar and unfamiliar fruits, vegetables, and desserts. In addition, children will engage in a behavioral task in which they are asked to try a series of familiar and unfamiliar foods. Mothers will complete a measure of their child's food neophobia. We hypothesize that neophobic children will be less likely to approach novel foods relative to non-neophobic children. Further, we predict that while some neophobic children will actively avoid novel foods, others will demonstrate low levels of approach and avoidance behavior toward novel foods. Distinguishing between these behavioral tendencies will allow us to better identify effective interventions for all neophobic children.

Christina Marlow is a first-year M.S. student in the Psychological Sciences Department at William & Mary. She has a broad interest in developmental psychology and her current research looks at the development of food preferences in childhood. She holds a B.A. (Psychology) from the University of Virginia.

Adolescent Engagement in Parent-Adolescent Interactions

Presenter: Molly Elizabeth Miller
Co-Author: A. Bell
Advisor: Janice Zeman
William & Mary,
Psychological Sciences

The consistency of positive parent-child interactions has been associated with better psychological adjustment for adolescents. Specifically greater parental warmth and support predict lower risky behaviors, less depressive symptoms, and fewer physical health problems in youth (Bornstein, 2006). However, Lerner (2013) suggests these outcomes are likely based on bidirectional effects as adolescents play an active role in interactions with their parent. Adolescents reference their history of interactions with their parent as they anticipate future social and emotional behaviors (Lerner, 2013). Youth who are more engaged with their parents perceive their parents as sources of emotional support and utilize their support in times of intense emotional distress (Helsen et al., 2000). When analyzing the quality of parent-child interactions, research generally focuses on a single facet of the interaction such as the overall quality of the parent-child relationship or a score for parental supportiveness (Abar et al., 2014; Van Petegem et al., 2017). Scant research has examined an adolescent's unique contribution to this interaction. The present study sought to determine whether a latent variable of teen engagement when conversing with a parent could be ascertained. Structural equation modeling was used to test this confirmatory factor analysis model. The model determined excellent fit. Findings highlight the importance of examining multiple dimensions of an adolescent's engagement with their parents during a discussion of salient and current friendship events.

Molly Miller is a second-year M.S. candidate in the Psychological Sciences Department at William & Mary. She is currently working on her Master's Thesis which looks at predictors of adolescent internalizing symptoms through the analysis of parent emotion socialization, adolescent adaptive emotion regulation, and adolescent friendship quality. She plans to continue on to a Clinical Psychology Ph.D. where she hopes to study predictors of psychopathology through examination of relationships.

e-Cultural Competence for U

Presenter: Nyx Robey
Advisor: Cheryl Dickter
William & Mary,
Psychological Sciences

Cultural competence has been an important and critical aspect of creating safe environments for individuals from racial minorities beginning in the health fields (Sue, Arredondo, & McDavis,1992; Montenery, Jones, Perry, Ross, & Zoucha, 2013; Shen, 2015; Young & Guo, 2016), and now expands into diversity initiatives on college campuses (Patterson, Papa, Reveles, & Domenech Rodríguez, 2018; Goldstein Hode, Behm-Morawitz, & Hays, 2018). The current study adapts an existing cultural competence intervention for online use by first-year White students at a predominantly White institution. Using a mixed-designs ANOVA, we seek to evaluate the efficacy of this intervention on measures of implicit racial bias through the Implicit Association Task (IAT; Greenwald & Banaji, 1995), the Awareness Skills Knowledge- General (ASK-G; Domenech Rodríguez, Reveles, Litson, Smith, & Patterson, 2018) scale to assess general cultural competence, and color-blindness using the Color-Blind Racial Attitudes Scale (COBRAS; Neville, Lilly, Duran, Lee, & Browne, 2000). After completing these measures at baseline, the experimental group will complete four weeks of intervention building awareness, knowledge, and skill. Follow-up measures will be taken at the end of the intervention. Data analysis is currently underway, and analyses will commence in the spring. Findings could show promise for use in training students upon entering predominantly White institutions in order to better inform policies and trainings surrounding diversity and inclusion.

Nyx Robey is a second-year M.S. candidate in the Psychological Sciences Department at William & Mary. Her research areas have spanned clinical and social psychology. Her thesis topic focuses on cultural competence amongst White students. She holds a B.A. (Psychology & Interdisciplinary Studies) from the University of California, Berkeley.

How State-Level Variables Interplay with Personality's Relationship to Political Orientation

Presenter: Nicholas Surdel
Advisor: Xiaowen Xu
William & Mary,
Psychological Sciences

What are the antecedents that lead to a person identifying as a conservative or a liberal? Previous literature has identified the Big Five personality traits openness to experience and conscientiousness as robust predictors of political orientation. However, recent research has suggested that, based on geographical reference points, there exist state-level differences in the degree of conservatism vs. liberalism one exhibits. That is, a self-identified moderately liberal individual residing in California would report higher endorsements for liberal policies than a self-identified moderately liberal residing in Texas. Based on these findings, it would be of interest to examine if the relationship between self-reported personality traits and political orientation may be moderated by political reference points at the state level. Participants across two studies (Study 1: N = 3218; Study 2: N = 3240) completed measures of Big Five personality, political orientation, and indicated their state of residence. Moderation analyses found that, although state partisanship and personality traits each individually predict political orientation, the interaction between these two predictors fails to suggest any significant moderation effect by state partisanship. Thus, based on the current samples, it may be the case that both state partisanship and trait personality are independent, unique predictors of political orientation.

Nicholas Surdel is a first-year M.S. student in the Psychological Sciences Department at William & Mary. His research interests include political orientation, morality, and identity.

Lumping and Splitting: Cognitive Style and Personality in Daily Life

Presenter: Peter Varga
Advisor: Todd Thrash
William & Mary,
Psychological Sciences

This study aims to distinguish cognitive integration (seeing similarities) from cognitive differentiation (seeing differences) at both between-person and within-person levels of analysis. Despite longstanding interest in specific literatures within psychology, researchers have not examined trait variance in these constructs nor state variance within persons. Our lab recently developed and validated a trait measure of integration and differentiation. Our prior studies indicate that at the between-person level, integration is related to positive emotions and differentiation is related to negative emotions. Both integration and differentiation were positively related to the big-five trait of openness to experience, but integration converged more strongly with the openness facet, and differentiation converged more strongly with the intellect facet. Integration was uniquely related to agreeableness, positive affect, life satisfaction, reflection, and inspiration. Differentiation was uniquely related to conscientiousness, need for precision, rumination, and an arrogant-calculating interpersonal style. In this study, I aim to (a) replicate a core subset of these findings, (b) extend them to the within-person level of analysis, and (c) examine cross-lagged effects in a daily diary design. Each of a starting sample of 220 undergraduate participants was asked to complete the same set of questionnaires each night for 14 nights, thus allowing separation of between-person and within-person effects. By formally conceptualizing and measuring these constructs, we pave the way for the continued examination and elaboration of integration and differentiation as fundamental to nearly every domain and as having implications for the process of formal academic research itself.

Peter Varga is a first-year M.S. student in the Psychological Sciences Department at William & Mary. He received his Bachelor's in Psychology from The Catholic University of America. As a classically trained musician, his research interests include social, personality, and motivation psychology approaches to inspiration and creativity in the humanities, particularly the performing arts. His current research examines cognitive integration and differentiation.

Probing Synergistic Effects of Social Dominance Orientation and Right-Wing Authoritarianism on Attitudes

Presenter: Emma Wedell
Advisor: Adrian Bravo
William & Mary,
Psychological Sciences

The present study will examine cross-sectional data of college students from two United States universities to investigate whether social dominance orientation (SDO) interacts with right-wing authoritarianism (RWA) in predicting various attitudinal measures. Data will be analyzed using PROCESS v3.4 macro for SPSS. Outcomes will include anti-Black prejudice, sexism, and numerous feeling thermometers. Beyond the expectation that SDO and RWA will be significantly associated with greater negative attitudes, we expect to find synergistic effects such that the associations will be more strongly negative for those scoring high on SDO and RWA.

Emma Wedell is a first-year M.S. student in the Psychological Sciences Department at William & Mary. Her research interests include disparities in substance use and abuse, racial prejudice and identity, and LGBTQ+ mental health and wellness. She is currently examining the roles of personality and ideological variables in predicting racial attitudes and beliefs.

Causal Effects of Environmental Instability in Early Childhood on the Development of Disruptive Behaviors into Adolescence

Presenter: Sean Womack
Co-Authors: C. Tong, K. Lemery-Chalfant, D. Shaw
Advisor: Melvin Wilson
University of Virginia,
Clinical Psychology

Previous research has demonstrated positive linear associations between instability in the form of residential mobility, family structure instability, and incarceration of parenting figures in early childhood and disruptive behaviors in late childhood. The present study expands on extant research by using group-based trajectory modeling to explore patterns of growth in instability across child age 2-5. Using propensity score weighting to balance the trajectory groups on demographic, family, and neighborhood variables, the present study estimates causal effects of instability group on trajectories of disruptive behaviors from ages 7-14. 731 caregivers reported on residential mobility, family structure instability, and live-in adult contacts with the law at ages 2, 3, 4, and 5. A curve-of-factor model was fit to estimate trajectories of disruptive behaviors based on primary caregiver, alternate caregiver, and teacher reports at child ages 7.5, 8.5, 9.5, 10.5, 14. A semi-parametric mixture model revealed two trajectories of environmental instability: high instability and chronic stability. After balancing the high instability and chronically stable families on demographic, family, and neighborhood variables, youth in the high instability group had a higher intercept of disruptive behaviors at each age. Instability group did not predict the slope of disruptive behaviors. Exposure to chronic instability in early childhood appears to be a causal factor in the development of disruptive behaviors across late childhood and into adolescence.

Sean Womack is a fourth-year Ph.D. candidate in the Clinical Psychology program at the University of Virginia. In his research, Sean takes a developmental psychopathology framework to examine sociodemographic influences on the development of emotional and behavioral disturbances. In his dissertation, Sean will explore causal influences of family structure instability on child emotional and behavioral development using a genetically informed design.

Exploring Personality Profiles Across Different Political Regions: An Application of Latent Profile Analysis

Presenter: Tianfang Yang
Advisor: Xiaowen Xu
William & Mary,
Psychological Sciences

Big Five personality traits have been shown to be one important psychological process that underlie differences in political orientation (Sibley et al., 2012). Other work found that political behaviors may be related to regional differences in personality (Rentfrow et al., 2013). The current study (N = 2978) extended existing work by examining whether there exists distinct personality profiles within Republican, Democratic, and swing regions of the US. Using latent profile analyses, we found that while all regions showed similar numbers (4 to 5) and patterns of personality profiles (e.g., well-adaptive individuals), regions that are Highly Democratic and Highly Republican showed unique personality profile patterns (e.g., "Disorganized & Reclusive," "Rigid & Antisocial") not found in other regions. While political differences between regions can manifest through differences in state-level personality, our finding highlights the importance of examining specific personality profiles within regions. This may provide more nuanced understanding of the dynamics of geographical polarization in the political climate.

Tianfang Yang is a second-year M.S. candidate in the Psychological Sciences Department at William & Mary. His research areas include personality traits, political psychology and geographical psychology. He graduated from Reed College in 2018 with a B.A. in Psychology.

In Another's Shoes: Visceral Emotional Experiences in Decisions for Self and Others in Risky Decision Making

Presenter: Ye Dam Yi
Advisor: Eric Stone
Wake Forest University,
Psychology

People make decisions for others that are systematically different from personal decisions. Previous research has shown robust evidence for social values theory as an explanation for self-other differences. In keeping with this theory, people take more risks for others when risk taking is socially valued but take less risks for others when risk aversion is socially valued, suggesting that people follow prescribed norms when deciding for others. This pattern of results holds even when people are told that others have preferences that run counter to social norms. However, highly empathetic people decide in line with others' known preferences that are counter-normative. This study examines whether the visceral experience of others' emotions can be manipulated to produce this same finding of counter-normative decisions for others. Participants will be Amazon Mechanical Turk (MTurk) Workers, who will make interpersonal decisions for themselves or others in situations where risk taking is socially valued. Half of the participants will be asked to imagine the potential negative and positive emotions associated with potential outcomes of the risk-taking alternative, with the aim of facilitating their ability to viscerally experience the emotions associated with the potential outcomes. We predict that, for personal decisions, participants in this facilitated emotional experience condition will make similar choices to those in the control condition, based on the assumption that for self decisions one normally experiences these emotions. However, we expect that participants making decisions for others in this facilitated emotional experience condition will make less risk-taking decisions, more in keeping with personal decisions, in comparison to those in the control condition.

Ye Dam Yi is a first-year M.A. student in the Department of Psychology at Wake Forest University. Her research areas include social decision making, emotion, and work environments. She is currently investigating whether emotional experiences influence the decision making process in interpersonal contexts.

Development of a Kite Aerial Photography Imaging Procedure to Expand GIS Analysis to Farmers Under Resource Constraints

Presenter: William N. Ferris
Advisor: Kurt Stephenson
Virginia Tech,
Agricultural and Applied Economics

This research seeks to develop a simple, low-cost methodology of using kite aerial photography (KAP) to conduct imaging and mapping of agricultural operations. The purpose of this research is to develop a means to overcome the cost- and training hurdles that conventional aerial imaging methods pose to farmers in developing countries who might otherwise seek to integrate geographic information systems analysis methods into their crop planning and analysis procedures. The author has developed a low-cost (sub-$150) methodology by which a stabilizing camera suspension rig can be flown from a delta kite to systematically collect images of agricultural operations, which can be merged using georeferenced ground features to create usable GIS layers and raster imagery files. Initial construction and testing of the rig and georeferencing methodology has yielded promising results. Final image collection will be conducted at Blacksburg, Virginia's Hale Community Garden. The results will be used to develop usable GIS layers and raster imagery of a real-world horticultural operation as a proof of efficacy of the developed methodology. This research has potential implications for the field of development economics. Providing farmers with a means to conduct aerial imaging and mapping themselves would reduce the burden on development organizations by allowing such organizations to focus solely on off-site image analysis, rather than on both on-site collection and subsequent off-site analysis. This would allow such organizations to boost operational efficiency and thus total reach.

William Ferris is a third-year Ph.D. candidate in the Agricultural and Applied Economics department at Virginia Tech. He is also completing a fellowship through the university's Institute for Critical Technology and Applied Science. His research areas include Chesapeake Bay denitrification, stormwater management, economic development, and applied geographic information systems. He holds a B.A. in Economics from William & Mary.

Of Democracies, Dictatorships, and Resource Deposits

Presenter: Jonathan Honig
Advisor: Brandon Prins
University of Tennessee,
Political Science

Third-party states considering whether to militarily intervene in an outside civil war may make the decision to act based on perceived self-interest in the valuable natural resources which may be found in a civil war-afflicted state. That being said, what characteristics of a third-party state are associated with policies of military interventionism? Drawing from selectorate theory, I hypothesize that the type of domestic regime in a potentially interventionist third-party state will affect when that country decides to adopt public policies leading to military intervention in an external civil war. My analysis examines the effect of natural resources, specifically petroleum and coltan, on which type of regime will intervene given those resources are located in the state experiencing the civil war. In line with my three hypotheses, I find that democracies will intervene more readily in countries which are oil producers and are experiencing a civil war, autocracies will intervene more readily in countries with known oil reserves (but not necessarily home to oil production), and similarly autocracies are more likely to intervene in coltan-possessing countries in the hope of gaining control over this valuable and easy to extract mineral when compared to their more domestic audience-sensitive democratic counterparts. The results largely support my theory that democracies will more readily act to support the energy system as a whole by intervening where vulnerable infrastructure and personnel associated with petroleum production are already in place, but are now in danger, in order to maintain a relatively comfortable standard of living for their populace. On the other hand, autocracies will intervene more readily where there are unclaimed and vulnerable known deposits of coltan and petroleum in order to reward their elites.

Jonathan Honig is a third-year Ph.D. Candidate and Teaching Associate in the Political Science Department at the University of Tennessee, Knoxville. His research interests include foreign policy, conflict mediation, global security, civil wars, dictatorships, and the role of natural resources in conflict. He received his Master's degree in Media and Communications, as well as his Bachelor's degree in Business Administration, both at Middle Tennessee State University.

Assessing the Extent and Domains in Which Students Worry

Presenter: Jade Kline
Advisor: David Kniola
Virginia Tech,
Educational Research and Evaluation

In today's society, students have multiple things they stress and worry about. Additionally, there is a rise of anxiety and depression among students over the past few years. Being aware of the extent and the domains in which students worry is beneficial to student affairs practitioners as well as higher education staff. Assessing the construct of worry among students can all inform professionals on ways to support student success and develop intentional programs to lessen the amount students worry. When conducting my literature review for this poster presentation, I am going to focus on analyzing the Student Worry Scale (SWS) which is a questionnaire that was developed to measure the construct of worry among college students. This questionnaire focuses on six different domains which contribute to worry among students: financial-related concerns, significant other's well-being, social adequacy concerns, academic concerns, and general anxiety symptoms. One area of focus is with academic concerns. If academic advisors were aware of trends in worry related to academic concerns, these staff could develop interventions with could lessen academic worry. Decreasing the amount of academic worry could result in higher grades and academic student success. In my poster presentation, I plan on defining the construct of worry, addressing how worry can be measured/assessed, as well as the practical implication for higher education institutions and staff.

Jade Kline is a second-year Ph.D. student in the Educational Research and Evaluation program at Virginia Tech. She has broad interests in student affairs assessment, data informed decision making, and quantitative research. Jade holds a M.S. Ed. from Old Dominion University and a B.B.A. in Business Administration and Management from Christopher Newport University.

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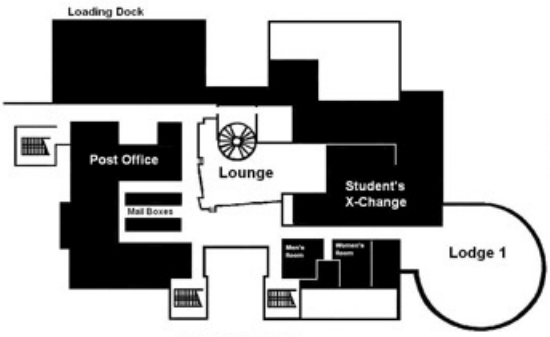

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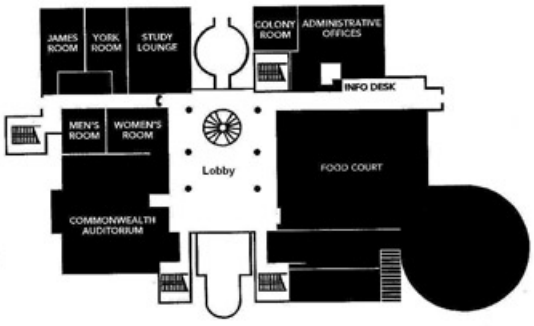

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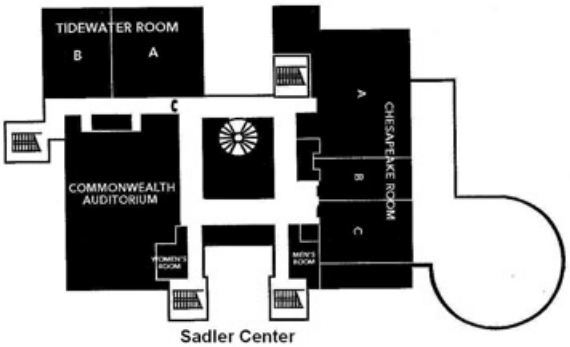

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