# 2023
# Dennis Dean Undergraduate Research & Creative Scholarship Conference

**Office of Undergraduate Research / April 28, 2023**

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# Welcome

## Jill C. Sible, Ph.D.

*Associate Vice Provost for Undergraduate Education*
*Professor of Biological Sciences*

Welcome to Virginia Tech's Spring Undergraduate Research and Creative Scholarship Symposium. This event celebrates the creative and scholarly accomplishments of undergraduate students' campus- wide. Our program reflects the quality and diversity of undergraduate research at Virginia Tech. Many of the projects are the result of collaborations among several students.

Undergraduate research is recognized as one of the high impact practices in undergraduate education. Students who participate in undergraduate research are more likely to thrive and persist in their education. They become co-creators of knowledge, makers of objects that are useful and beautiful. At the heart and soul of these projects are collaborations between undergraduates and their mentors. Many thanks to the faculty, graduate students, and others who commit to these scholarly endeavors with undergraduate students.

We also welcome local high school students who have engaged in research under the mentorship of Virginia Tech faculty. We hope that your experience has sparked a passion for research and a lifetime of curiosity.

Many thanks to Keri Swaby, Director of the Office of Undergraduate Research, for her steadfast leadership and advocacy for undergraduate research and to the entire team in the Office of Undergraduate Research.

Thanks to the Fralin Life Sciences Institute, and to Dr. Dennis Dean for continuous support and advocacy for undergraduate research and to the many colleagues who have contributed to building an endowment for this symposium.

My best,
Jill

# Office of Undergraduate Research

## Keri Swaby

*Director of Undergraduate Research*

Welcome to the annual Dennis Dean Undergraduate Research and Creative Scholarship conference, hosted by Virginia Tech's Office of Undergraduate Research (OUR). This event will showcase the breadth of research and creative scholarship taking place across campus every day and will demonstrate how broadly we define this impactful form of experiential learning.

Presenting results of a research or creative project is an important part of a student's overall journey because it provides them with the opportunity to learn to effectively communicate to a broad audience, defend their work, exchange ideas, and be inspired for future directions in their work. This year we will feature the work of 369 students, including eight (8) students from Blacksburg High School, who will present 210 posters throughout the day. I invite you to take your time and explore the many offerings at the conference and I challenge you to stop at posters with titles that that intrigue you, but also those that scare you. You will be impressed by the variety and high quality of the work on display.

The conference is only possible through the incredible hard work of our Program Assistant, Nicole Bottass, and Project Manager, Sophie DeSimone; the guidance of an active and insightful advisory board; and the army of amazing Ambassadors who share their passion every day as they help students navigate undergraduate research. Without these dedicated people, the operations of the OUR would not be possible.

I must recognize and specially thank the Fralin Life Sciences Institute and the Institute for Critical Technology and Applied Science, whose financial support allows us to celebrate undergraduate research and creative scholarship today and every day. I must also highlight the generous support of the 4-VA at Virginia Tech, who awarded us a special grant that is enabling us to provide good for conference presenters.

As always, I am humbled by the quality of work on show as part of this conference and invite you to marvel at the wealth of research and creative scholarships the university has to offer. I invite you to engage, to explore, to connect and to have fun!

Keri

# ACC Meeting of the Minds

The 2023 ACC Meeting of the Minds (ACC MOM) was held at Virginia Tech. The scheduled conference dates were March 24-26, 2023. The Office of Undergraduate Research would like to recognize the students who presented.

Each year, 5-10 outstanding undergraduate researchers (accompanied by a faculty/staff member) from each ACC university gather at a host institution to present their research, either orally or as a poster. Virginia Tech representatives are selected by a competitive refereed process. It is truly an honor to be invited to participate in this conference. Student name, academic major, title of presentation, and faculty mentor listed below alphabetically.

**Cassandra Cogan**, International Relations
*The ICC, the US, and France: Can We Move Past Hypocrisy and into the Future of International Justice?*
Dr. Paul Heilker

**Loralee Hoffer**, Psychology
*Interpersonal Impact of Diffusion of Responsibility: Behavioral Observations of Pedestrians Using Campus Crosswalks*
Dr. Scott Geller

**Sasha Mintz**, Physics and Mathematics
*Cold Quasar Investigation: Comparing Central Star Formation Ratest to Black Hole Growth*
Dr. Allison Kirkpatrick

**Victor Murkura**, Computational Modeling and Data Analytics
*Practical Application of Machine Learning to Solar Energy*
Dr. Anne Brown

**Zainab Shamim**, English Literature
*Of Race and Caste: Discrimination Across Cultures in Shakespeare's Othello and Bhardway's Omkara*
Dr. Katharine Cleland

# NCUR

The 2023 National Conference on Undergraduate Research (NCUR) was held in Eau Claire, Wisconsin. The scheduled conference dates were April 12-16, 2023. The Office of Undergraduate Research would like to recognize the students who were selected to present.

The National Conference on Undergraduate Research (NCUR), established in 1987, is dedicated to promoting undergraduate research, scholarship, and creative activity in all fields of study by sponsoring an annual conference for students. Unlike meetings of academic professional organizations, this gathering of young scholars welcomes presenters from all institutions of higher learning and from all corners of the academic curriculum. Through this annual conference, NCUR creates a unique environment for the celebration and promotion of undergraduate student achievement, provides models of exemplary research and scholarship, and helps to improve the state of undergraduate education.

Student name and academic major listed below alphabetically.

**Eric Hoffman**, Mechanical Engineering

**Hannah Jane Upson**, Political Science

**Irene Johns**, Mechanical Engineering

**Mackenzie Woolls**, Public Health

**Shane Lee**, Political Science & PPE

**Victor Mukora**, Computational Modeling and Data Analytics

**Vittorio Pastore**, Mechatronics Engineering - RBMT

**Woongseok Han**, Robotics and Mechatronics

**Zachary Fuge**, Robotics and Mechatronics

# Informational Booths

We invite you to visit and talk with representatives from several graduate programs, from across Virginia Tech's Blacksburg, Roanoke, and National Capital Region campuses.

## Environmental Health and Safety

## Molecular and Cellular Biology Graduate Program

## Translational Biology, Medicine, and Health

## Office of Scholarly Integrity and Research Compliance

## Online Masters of Ag and Applied Economics

## University Libraries

## Virginia Tech Graduate School

# 2022-23 Travel Grant Awards

The Virginia Tech Office of Undergraduate Research encourages students to present their research at conferences. OUR travel support program will cover expenses related to presenting at a conference. This rolling review process is designed to assist undergraduate students who have had their research or creative scholarship accepted for presentation at a regional, national, or international conference. This program will provide travel funding to students who, without this support, may not be able to attend a conference to present their work. Current undergraduates from any discipline are eligible to apply for travel support.

**Hannah Jane Upson**, Political Science, College of Liberal Arts and Human Sciences
Faculty Mentor: Dr. Monique Dufour
The Society of Study if Social Problems 72nd Annual Meeting, August 4-8, 2022

**Sonia Warrior**, Cognitive and Behavioral Neuroscience, College of Science
Faculty Mentor: Dr. Bruce Friedman
Society of Psychological Research. September 28-October 2, 2022

**Shane Lee**, Political Science, College of Liberal Arts and Human Sciences
Faculty Mentor: Dr. Jennifer Johnson
Mid-Atlantic Conference of Undergraduate Scholarship, October 22, 2022

**Jake Adams**, Chemical Engineering, College of Engineering
Faculty Mentor: Dr. Erdogan Kiran
2022 AlChE Annual Student Conference, November 11-14, 2022

**Dokyung Rhee**, Chemical Engineering, College of Engineering
Faculty Mentor: Dr. Erdogan Kiran
2022 AlChE Annual Student Conference, November 11-14, 2022

**Kathleen Reuwer**, Experimental Neuroscience, College of Science
Faculty Mentor: Dr. Jennifer Rainville
Neuroscience 2022, November 12-16, 2022

**Lauren Meier**, Clinical Neuroscience and Psychology, College of Science
Faculty Mentor: Dr. Meagan Brem
Association for Behavioral and Cognitive Therapies, November 17-20, 2022

**Danya Nahas**, Chemistry, College of Science
Faculty Mentor: Dr. John Morris
The Chemical & Biological Defense Science and Technology, December 6-9, 2022

**James Mckendrick**, Mechanical Engineering, College of Engineering
Faculty Mentor: Dr. Sara Arena
Orthopaedic Research Society, February 10-14, 2023

**Yannick Pleimling**, Physics, College of Science
Faculty Mentor: Dr. Giti Khodaparast
APS March Meeting 2023, March 5-10, 2023

**Zachary Sherman**, Geography GIS, College of Natural Resources and Environment
Faculty Mentor: Dr. Thomas Crawford
Interpore: International Conference on Porous Media, May 22-25, 2023

**Miriam Hilt Wildlife Conservation**, College of Natural Resources and Environment
Faculty Mentor: Dr. Holly Kindsvater
Southeast PARC Annual Meeting, February 23-26, 2023

**Seth Jarvis**, Biomedical Engineering, College of Engineering
Faculty Mentor: Dr. Christopher Arena
Design of Medical Devices, April 17-19, 2023

# Office of Undergraduate Research Ambassadors

**Amiya Jenkins** (Graduation: Spring 2024)
Medicinal Chemistry & Biochemistry – Medicinal Chemistry, Natural Products, Drug Discovery

**Hajar Chokhmane** (Graduation: Spring 2024)
Mechanical Engineering – Studying the role of nanoscale surface features on microbial adhesion and proliferation on polymeric material, with the objective of optimizing the design of anti-adhesion topography and combating biofilm formation on medical devices.

**Jennie Lee** (Graduation: Spring 2023)
Chemistry – Microplastic Transport, Fate of Pollutants, Atmospheric Science

**Loralee Hoffer** (Graduation: Spring 2023)
Psychology – Behavior, expressions of gratitude, positive psychology, and psychological aspects of wellbeing

**Makenzie Woolls** (Graduation: Spring 2023)
Public Health – Immunology, Virology and Plant Genetics

**Maddie Ferguson** (Graduation: Spring 2023)
Biochemistry – Anaerobic methanogen growth and analysis, nitrite, and sulfite reductase

**Madison LaRoche** (Graduation: Spring 2023)
Clinical Neuroscience & Honors College – Drug Addiction, Psychiatric Disorders, Neurogenetics and Preventative Medicine

**Morgan Harvey** (Graduation: Spring 2024)
Environmental Science – Sustainable materials and agricultural greenhouse gases

**Nikki Keith** (Graduation: Fall 2023)
Biological Sciences & Clinical Neuroscience – Histotripsy, Focused Ultrasound, Neuro-oncological Therapeutics, Medical Device Development

**Olivia Basco** (Graduation: Spring 2023)
Biological Systems Engineering & French – Anti-opioid addiction vaccines & transmission of Pneumonia through the water supply

**Olivia Cox** (Graduation: Spring 2025)
Psychology And Human Development– Child and Clinical Psychology

**Pete Ngwa** (Graduation: Spring 2024)
Computer Science– Converting the voltage produced in wavelengths by the brain into mechanical motion by using machine learning algorithms to analyze the live data output from the EEG reading software to then pair with a series of motors that turn on and off based on the software's output, with the primary goal of controlling a fully operating bionic arm with one's thoughts.

**Samantha Tollefson** (Graduation: Spring 2024)
Biochemistry – Natural Product Chemistry, Drug Discovery, Drug development

**Sasha Mintz** (Graduation: Spring 2024)
Physics – Astrophysics, Cosmology, Particle Physics

**Victor Mukora** (Graduation: Spring 2022)
Computational Modeling and Data Analytics – Solar Energy, specifically applying data analytics to enhance solar panel efficiency.

**Yasmin Farzan** (Graduation: Spring 2023)
Chemical Engineering – Organometallics and Catalysis

# 2022-23 Outstanding Undergraduate Research Mentor Award

An often overlooked, unrecognized and unrewarded mode of teaching is mentoring undergraduate students in research. Four years ago, the Office of Undergraduate Research launched the Outstanding Undergraduate Research Mentor Award - for a Faculty and a Graduate Student - to recognize the hard work, time, dedication, and guidance that research mentors provide to undergraduate students.

Undergraduates were asked to nominate one Virginia Tech faculty or graduate student research mentor from any discipline for this award. We received nominations for faculty members and for graduate students. It was extremely humbling and inspiring to review the thoughtful and passion-filled nominations. Many recognized the tireless and often unrewarded efforts of their mentors and indicated that their mentor made their Virginia Tech experience unique and overwhelmingly had a positive impact on their future plans.

*Webster Santos*

*Jessica Gannon*

The recipient of this year's **Outstanding Undergraduate Research FACULTY Mentor Award is Webster Santos, PhD, Professor of Chemistry**. In their nominations, the students described Dr. Santos as willing sharing and available.

The recipient of this year's **Outstanding Undergraduate Research GRADUATE STUDENT Mentor Award is Jessica Gannon (Biomedical Engineering)**, who received three nominations. In her nominations, Jessica was described as approachable, supportive, inspirational, knowledgeable, and patient.

Thank you to all undergraduate research mentors. Without mentors, students could not engage in research and without exceptional mentors, students would not gain as much out of the research experience!

# Thank you!

For sharing your knowledge, experience, advice, and hard labor with us and your fellow students, faculty, and staff at Virginia Tech. The Office of Undergraduate Research would not have near the impact or be able to provide near the opportunity without your incalculable dedication and support.

## Advisory Board

Amanda MacDonald
Anne Brown
Brian Badgley
Carrie Kroehler
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Ehren Hill, Co-chair
Eli Vlaisavljevich, Co-chair
Frank May
Konark Mukherjee
Kory Trott
Mary Kasarda
Matthew Kovach
Monica Hunter
Shahabedin Sagheb
Shaila Megra
Stephanie (Nikki) Lewis
Yancey Crawford

# Conference Schedule & Abstracts

# Conference Schedule

## Session A: 8:00-8:50 a.m.

| Primary Presenter Last Name | Presentation Title | Poster Number |
|---|---|---|
| Barnes | The Roles of Spore Inner Membrane Lipids in Bacillus subtilis Resistance Properties | 1 |
| Bautista | Does water flow across the drainage divide of the Brush Mountain ridge? | 2 |
| Burgos | The Effects of Financial Stress on Depression and the Mediating Roles of Parental Behaviors in Mexican American College Students | 3 |
| Cappellina | The effect of intercropping legumes with grasses on the fiber ruminal digestion kinetics of the forages. | 4 |
| Coyle | House Finch Innate Immune Responses Vary with Ambient Temperature as Indicated by Haptoglobin | 5 |
| Crum | Terrible roommates: Invasive crayfish serve as incompetent surrogate hosts for native symbionts. | 6 |
| Eroshenko | Does Biochar Make Sandy Soil More Sticky | 7 |
| Hamad | Biochemical Pathways of Food Allergies | 8 |
| Harrison, G | Using Gradient-Boosted Machine Learning Models to Forecast Lake Water Quality | 9 |
| Harrison, E | Molecular and gene expression changes in liver tissue from mid-lactation dairy cows supplemented with methionine during a subclinical mastitis challenge. | 10 |
| Hilt | Examining Phenotypic Plasticity In Thermal Acclimation Of Metabolic Rate In Plethodon Cinereus | 11 |
| Johnson | Exploration of Sustainable Insulation Material and Package Design | 12 |
| Keith | Characterizing a 6.3 MHz High Frequency Endoscopic Histotripsy Device for Noninvasive Tumor Ablation | 13 |
| Kesoglu | The Effects of Different Genres of Music on Information Retention | 14 |
| Krebs | A Study of Exponent and Pramp as Technical Interview Preparation Tools | 15 |
| Lee, S | Load Shedding in South Africa: How Solar Panel Deployment Can Alleviate Race-Based Inequalities | 16 |
| MacNicol | Synthesis and evaluation of thermoresponsive copolymers for the extraction of rare-earth elements | 17 |
| Mehari | The Role of eNOS in Mediating Stress Responses to Acute Aerobic Exercise in Liver | 18 |

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| Moses | The Role of eNOS on Skeletal Muscle Adaptation During Exercise (Whole Gastrocnemius) | 19 |
| Rami | Mosquito Larvae Ecology Mediates Central and Periphery Neural Encoding of Host Odors in Aedes aegypti | 20 |
| Ravigopal | Maternal and Developmental Factors in Predicting Anxiety Problems | 21 |
| Saunders | Relationship Between Methane Production and VFA concentration in Dairy Cows Fed with Ethanol-Based Feedstuff | 22 |
| Schmidt | Public Outreach to Prevent Feline Poisonings in Virginia | 23 |
| Sherman | An Upscaled Modeling Framework for Reactive Transport: A Case Study - Dry Creek, Idaho | 24 |
| Tunstall | A mediation model examining the association between sexual assault experiences(SES) and alcohol use problem (AUDIT) mediated by anger (BPAQ-Anger subscale). | 25 |
| Yedla | Gas-Chromatography Mass-Spectrometry-based Plasma Metabolomic Analysis of Type 2 Diabetes in Mice | 26 |

## Session B: 9:05-9:55 a.m.

| Primary Presenter Last Name | Presentation Title | Poster Number |
|---|---|---|
| Atkinson | Tensile Evaluation of the Vaginal Canal in Swine for Vaginoplasty | 1 |
| Bowen | SWVA: Not Just Southern; Investigating Dialect Boundaries in Southwest Virginia | 2 |
| Castro | Predictors of ADHD Symptoms In Middle Childhood | 3 |
| Davis | American Black Bear Foraging Patterns Potentially Alter Central Appalachian Flora Through Consumption and Spread of Invasive Species | 4 |
| Distler | Observed Differences Among White-Tailed Deer Populations in Private and Public Land | 5 |
| Fisher | Housing Instability as a Risk Factor for Increased Adverse Childhood Experiences | 6 |
| Green | More Concrete, More Cowbirds - Impervious Surface Cover Influences Brood Parasitism Rates of Song Sparrow (Melospiza melodia) Nests in the New River Valley | 7 |
| Harikar | Is a Basis in Semantic Knowledge Required for Unitization of Item and Context Features in Episodic Memory? | 8 |
| Hunter | How The Interaction Between Negative Maternal Characteristics and Temperament Predicts The Development of Inhibitory Control in Toddlers | 9 |

## Session C: 10:10-11:00 a.m.

| Primary Presenter Last Name | Presentation Title | Poster Number |
|---|---|---|
| Aardema | Effects of microplastics on C. elegans memory and motion | 1 |
| Asad | Examining the Impact of a Storybook Series Designed to Strengthen Math Identity in Black and Latine Students and Students Experiencing Poverty | 2 |
| Athanasaw | Weight Self-Stigma Predicts Eating Disorder Symptoms Among College Students Across One Semester | 3 |
| Carroll | Rural-Urban Bias In Large Language Models Using Spatial Analysis | 4 |
| Craig | Administrators' Perceptions of Family-Based Treatment Barriers and Facilitators for LGBTQ Youth with Suicidal Ideation and Behavior | 5 |
| Crocker | AutoPlane | 6 |
| Dressel | Seeing Heat in 3D: Multisensor Integration for Comprehensive 3D Thermal Mapping and Modeling | 7 |
| Farmer | Investigating ocelot interactions with camera traps as a source of bias in density estimation | 8 |
| Finks | Native Lianas of Virginia's Appalachian/Blue Ridge Forests: Environment and Ecology | 9 |
| Fuge | Implementation of Path-Planning onto the Quadruped Robot, SQUEAKY | 10 |
| Gauza | Search for Novel Metabolites Through Untargeted Metabolomic Analysis in Methanococcus maripaludis | 11 |
| Gilmore | Effect of Conjugated Linoleic Acid Supplementation on Skeletal Muscle Composition in Mice | 12 |
| Greear | Examining the Relationship Between Nomadism and Life History Traits in Avians Using Phylogenetic Comparative Methods | 13 |
| Gregory | Understanding Regulation of Mitochondrial Function by Immune Receptor NLRX1 during Lyme Disease | 14 |
| Harman | Bat guano isotope evidence for past vegetation and climate change in southwest Virginia | 15 |
| Hilton | Behavioral Observations of Interpersonal Gratitude on Campus Buses: Modeling vs. Diffusion of Responsibility | 16 |
| Meier | Q&A on Zoom for preschoolers: The impact of on-screen partner's questions on preschoolers' word learning and memory of content from shared book reading over video chat | 17 |
| Montgomery | Plastic Degradation in Stream Habitats | 18 |

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| Paolucci | Investigating magma sources that drive volcanic deformation in Tanzania | 19 |
| Payne | Making Food Babies: Generating Embryogenic Callus for Enhanced Food Production | 20 |
| Rankin | Cover Crop Seed Diversity's Effect on Overall Plant Diversity | 21 |
| Rubin | Heterologous Expression and Purification of NafZ glutaredoxin from Azotobacter vinelandii | 22 |
| Schiff | Dynamics of Tick-Borne Co-Infections | 23 |
| Shepard | Effects of the FAAH P129T mutation in mice on operant responding using FED3 | 24 |
| Turner | La Crosse vector competency of container-breeding mosquitoes contrasting different viral strains and two environmental temperatures | 25 |
| Zaccaria | The Role of Parent Personality, Parenting Behaviors, and Child Temperament in Parent-Child Dyadic Interactions | 26 |

## Session D: 11:15 a.m.-12:05 p.m.

| Primary Presenter Last Name | Presentation Title | Poster Number |
|---|---|---|
| Ali | GPUs vs. CPUs with Deep Neural Networks and Matrix Multiplication | 1 |
| Baum | Influence of Materials and Manufacturing Method on Product Life Cycle Impacts | 2 |
| Crum | Utilization of Stormwater Retention Ponds in Blacksburg and Christiansburg, Virginia by Frogs and Toads | 3 |
| Ferguson | Assessment of Microplastic Contaminants Between Native and Invasive Crayfish Across Various Levels of Habitat Degradation | 4 |
| Finks | Exploring Critical Zone Controls on Runoff Generation in 92 watersheds across the Southern Appalachian Mountain Region | 5 |
| Gill | The Role of Endothelial Nitric Oxide Synthase in Exercise-Induced Gene Expression Changes in the Heart | 6 |
| Girgente | Reconstructing the Past Environment around Mountain Lake, Giles County, VA | 7 |
| Hoffer | Diffusion of Responsibility as a Determinant of Interpersonal Gratitude: A probability analysis of the interpersonal gratitude expressions of pedestrians | 8 |
| Hucker | Natural Language Processing | 9 |
| Katayama | Exploring Fluoride Impact and Concentrations in Well Water Across Virginia Counties | 10 |
| Lee, J | Detection of Atmospheric Microplastic Fallout in the Southwestern Appalachian Mountain Region | 11 |

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| Lyles | The Detour to Tissue Viability: How Vasculotide Affects Blood Vessels Post-Stroke | 12 |
| Moore, T | Disappearing Voles – Least Weasel presence decreased vole observations in Mostela boxes | 13 |
| Parker-Rollins | Practical Interventions to Increase the Use of Reusable Bags for Groceries | 14 |
| Pastore | Development of a 3-phase, Affordable, and Modular 3D Printed Quadruped Robot | 15 |
| Pham, S | Exploring the evolution of morphological diversity in two convergent lizard clades | 16 |
| Reichard | The Effects of the Placement of Hand Dryers on the Growth of Bacterial Colonies | 17 |
| Sciortino | The Impacts of the Virginia Tech Therapy Dog Program on Student Mental Health | 18 |
| Scott | Child Temperament and Parenting Behaviors Predict Adolescent Executive Functions | 19 |
| Sloop | Conversate: Community Viability, Growth, and Opportunity | 20 |
| Stallard | Micronutrients as Predictors for Markers of Bone Health in Athletes | 21 |
| Sullivan | The Role of Mindfulness as a Mechanism for Improving Self-Compassion and Reducing Anhedonia | 22 |
| Upson | Dehumanization and Reporting: The Denial of Native Women's Reproductive Rights | 23 |
| Venkanagari | Going With The Flow: Interactions of Interstitial Fluid Flow from the Brain to the Lymph Node in Cancer | 24 |
| Weitzenhofer | Assessing American Black Bear (Ursus americanus) Proximity to Human Settlements via Video Camera Collars in Rural Bath County, VA | 25 |
| Woolls | NLRX1 Modulation of Sars-CoV-2 Immune Response | 26 |
| Hines-Pressley | Molecular docking of a novel small molecule into HIV Gp41 | 27 |

## Session E: 12:20-1:10 p.m.

| Primary Presenter Last Name | Presentation Title | Poster Number |
|---|---|---|
| Abisamra | Lipidomic Analysis of the Giant Virus PBCV-1 | 1 |
| Buccarelli | Analysis of the FADS1 gene missense variants using in silico analysis to identify pathogenic variants in the human gene (S. Buccarelli, R. Steinbach, S. Mauro and D.J. Good) | 2 |
| Budzyn | Environmental Education in Kasane, Botswana | 3 |
| Cannon | Molecular Basis for the Interaction of Phafin2 with the Actin Network During Macropinocytosis | 4 |
| Duong | Assessment of the bacterial microbiome on Virginia amphibians across life stages | 5 |

## Session F: 1:25-2:15 p.m.

| Primary Presenter Last Name | Presentation Title | Poster Number |
|---|---|---|
| Akanmu | Differences in the physical and structural changes during microglial activation in pediatric and adult glioma models | 1 |
| Bartlett | Comparison of the Binding Affinities of Fentanyl and a Derivative of Narcan in the MU Opioid Receptor | 2 |
| Beaman | Smartphone Use Explains the Relationship Between Home Chaos and Discipline Type | 3 |
| Bilski | Investigating the Effect of Residue Changes in the Binding Cavity of E. coli Glucokinase | 4 |
| Choi | Sustainable Materials | 5 |
| Clauss | Identifying Skill Gaps Between University Programs and Related Careers with a Focus on Industrial and Systems Engineering | 6 |
| Connors | Does edge proximity impact thermal tolerance of Solenopsis invicta | 7 |
| Greatorex-Potter | Using In-Silico Techniques to Design Novel Antagonists of Propanediol Dehydratase | 8 |
| Guth | Viral Interference in Intercellular Communication: An Exemplification of Scientific Trial and Error | 9 |
| Hoernig | Analysis of Iron-Sulfur Cluster Association with a Non-Canonical Thioredoxin in Methanocaldococcus jannaschii | 10 |
| Jung | Ligand bindings and its relation to Alzheimer's disease | 11 |
| Kamineni | Peptide-Membrane Simulations and Identification of Key Residues in Brome Mosaic Virus Replication Protein 1a ER Targeting | 12 |
| Killeen | Investigating the Affinity of an Antagonist on the Beta-Lactamase Receptor | 13 |
| Kouzel | Comparison and Validation of Frequently Used Molecular Docking Software Using a Diverse Ligands Set | 14 |
| Levon | Assessing the Impact of Predatory Amphibians on the Biodiversity and Community Structure of Invertebrates in Intermittent Ponds of the American Southwest | 15 |
| Lewton | Examining relationships between mother and cub jaguars from remote camera trapping data in Belize, Central America. | 16 |
| LoPresti | Exploring the Dynamic Landscape of the NS2B/NS3 Protease in the Dengue Virus Using All-Atom Molecular Dynamics Simulations | 17 |
| Marker | How Distance from Water Affects Cover Crops | 18 |

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| Olivo | Case Study of Urban Reforestation Efforts a Decade After Tornado Destruction of a Southwest Virginia Community | 19 |
| Pereira | Healthcare Inequities Among Disabled Groups in the U.S. Contextualized through Cerebral Palsy | 20 |
| Puri | Temperament and Education Factors in Predicting Externalizing Behaviors in Middle Childhood | 21 |
| Short | Production of Butyrate from Inulin by Co-culture with Coprococcus eutactus, Lactobacillus plantarum, and Methanobrevibacter smithii | 22 |
| Smith, A | F 420 -dependent sulfite reductase gene as selectable marker in sulfite sensitive methanogens | 23 |
| Tury | Assessing Spatial and Temporal Activity of Native and Invasive Amphibians through Bioacoustic Remote Sensing Technology | 24 |

## Break: 2:15-2:55 p.m.

## Session G: 2:55-3:45 p.m.

| Primary Presenter Last Name | Presentation Title | Poster Number |
|---|---|---|
| Alexander | Relic red spruce: Factors associated with current and future ecosystem conditions | 1 |
| Callaway | Exploring New Ligands to Combat Antibiotic Resistance in M. Tuberculosis Beta-Lactamase | 2 |
| Christensen | Comparative Content and Engagement Analysis of Credentialed and Non-Credentialed Nutrition Professionals on Instagram | 3 |
| Dunn | Investigating Fast Fashion: Analysis of Inhumane Working Conditions in India, Bangladesh, and Thailand | 4 |
| Foster Trask | Using by-catch data from remotely-triggered cameras to assess distribution and abundance of a little known small felid, the margay, in Belize, Central America | 5 |
| Glass | Analyzing the effectiveness of alternative fuels as a replacement for petroleum fuels in the Montgomery County area | 6 |
| Guilliano | Exploring the Relationship between Abiotic Factors and Biodiversity in Ephemeral Freshwater Systems of Southeastern Arizona | 7 |
| Hanna | Perceptions of Non-Verbal Communication in Automotive Contexts | 8 |
| Jones | Investigating the Effect of Heat Treatment on Peanut Pollen Fatty Acid Saturation Levels | 9 |
| Klein | A comparison of the effects of Huperzine A and Tacrine as inhibitors on Acetylcholinerase | 10 |

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| Lydic | Interpersonal Gratitude and Subjective Well Being at Pedestrians Crosswalks: Demonstrating functional control of a practical intervention | 11 |
| Meluch | Effect of In Ovo Feeding of Probiotics on Intestinal Cell Populations in Chickens | 12 |
| Morse | Escaping a Glass Trap – Treated Glass Surface Can Provide a Solution for Shrew Mortality | 13 |
| Mukora | Application of Real-Time MLR to Predicting Solar Energy | 14 |
| Nystrom | Acetylcholinesterase Mutagenesis: The Effect of a Non-polar R Group on Huperzine A's Affinity for the Active Site of the Enzyme, Acetylcholinesterase | 15 |
| O'Brien | Mutagenesis of Trytophan-293 | 16 |
| Ohri | Impact of Asn99Met on Glucokinase Binding Affinity for Glucose | 17 |
| Paz | Quantifying changes in extreme rainfall characteristics through time | 18 |
| Pradhan | Exploring Nutrient Reward Learning in Obesity: A Pilot Study on the Signaling Pathway between the Gut and Brain | 19 |
| Rahn | Domestic animal plant poisoning reports: an analysis of trends in Virginia from 2001 - 2021 | 20 |
| Reuwer | Examining Astrocyte Plasticity and Synapse Formation in Rodent Whisker Barrel Cortex | 21 |
| Rhodes | Jasmonic Acid-Amido Synthetase (JAS) in Complex with Jasmonyl-Leucine | 22 |
| Stripling | Impact of Organic Fertilizers on Mustard Plant Development and Soil pH | 23 |
| Sturniolo | Utilization of Computational Data to Compare the Binding Affinity of Morphinan versus Fentynal in the μ-Opioid Receptor (μOR) of Mus Musculus | 24 |
| Tury | Male song sparrow (Melospiza melodia) territoriality and aggression during the non-breeding season | 25 |
| Zaheer | Sequence effects on the aggregation dynamics of functional β-endorphin vs. cytotoxic amyloid-β | 26 |
| Jenkins | Dereplication of Bacterial Metabolites Associated with Moon Snail Eggs by NMR metabolomics | 27 |

## Session H: 4:00-4:50 p.m.

| Primary Presenter Last Name | Presentation Title | Poster Number |
|---|---|---|
| Bickley | Extracellular electrophysiology in Drosophila melanogaster post transcriptionally silenced to reduce expression of the Type-B muscarinic acetylcholine receptor | 1 |
| Breeden | Impacts of Artificial Intelligence on Manufacturing Companies in Virginia | 2 |
| Brown | The Economic Impact of Hosting the Super Bowl | 3 |

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# Abstracts

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**Effects of microplastics on C. elegans memory and motion**

The aim of this study is to investigate the effects of direct microplastic exposure on C. elegans' ability to move and learn, as well as potential generational effects of microplastic exposure. This information is critical because microplastics are increasingly being found in our environment and our bodies. Understanding the effect microplastics have on C. elegans is important for understanding how microplastics are affecting our environment and our health. We treated C. elegans with four different concentrations of microplastics (0 µg/mL, 0.333 µg/mL, 3.33 µg/mL, 33.3 µg/mL) and observed movement. We will also administer a learning assay and an oxidative stress test. Based on current data, microplastic exposure does not appear to impede movement, but we hypothesize that exposure to microplastics will induce an oxidative stress response in C. elegans and thus impair performance on the associative memory assay.

**Mentor(s):** Jennifer Rainville (School of Neuroscience), Virginia Tech

**Elea-Maria Abisamra**
Virginia Tech/Nanomedicine

**Andrew Jelinsky**
Virginia Tech/Biological Sciences

**Lipidomic Analysis of the Giant Virus PBCV-1**

A lipidomic analysis of a giant virus named Paramecium Bursaria Chlorella Virus 1 (PBCV-1), a virus of an algae that lives inside of Paramecium bursaria. Lipidomics is a recently emerged field focused on cellular lipids and primarily utilizes mass spectrometry, which measures mass-to-charge ratios (m/z). Using the Lab Solutions software and a variety of resources, we were able to identify the four primary lipid classes within the first week: diacylglycerols, phosphatidylcholines, glycosyl-based lipids, and cardiolipins. Since then, we have worked to find each class' specific lipid constitutes in the sample.
By combining different softwares, such as Labsolutions CS, the MoNA MassBank of North America, and LipidMaps.org, we were able to identify the most abundant lipids in the sample based on the length of their fatty acid chains and chemical modifications of their structures. Once a lipid was identified, a Lipid Maps ID was evaluated from the database, which provided established MoNA Spectra data. The MoNA Spectra had to match the Labsolutions data from our sample for the targeted lipid to prove a match.
We have purchased the most relevant lipids to generate artificial lipid bilayers known as liposomes, and will use liposomes to reconstitute the binding of the purified major capsid protein of PBCV-1 to lipid bilayers. This protein, known as VP-54, is located at the lipid bilayer surface of the virus and it is essential for infectivity. With this analysis, we hope to be able to identify the lipid ligand for VP-54.

**Mentor(s):** Dr. Daniel Capelluto (Biological Sciences), Virginia Tech

**Mercy Akanmu**
Blacksburg High School/Advanced Diploma

**Differences in the physical and structural changes during microglial activation in pediatric and adult glioma models**

Gliomas are a deadly form of brain cancer. Methods of treating gliomas are failing to induce major changes in living quality and life expectancy in those afflicted. While this type of cancer has different classifications and grades of severity that affect individuals in different ways, the prognosis is usually fatal. This incapacity to provide care expands across both pediatric and adult populations, leading to about 10,000 fatalities annually. Studies have examined the body's natural response to malignant cell growth, including the immune response of microglia cells. However, there are scarce studies relating to variance in response to gliomas in pediatric and adult gliomas. This paper investigates the differences between the activation of microglia cells (microgliosis) in response to gliomas and the average count of the microglia cells in adult and pediatric populations. Tissue was stained using the Avidin Biotin Complex Method (ABC) method, and images were analyzed using ImageJ. This study found a mean fluorescence of 21.444 and a mean cell count of 66.5 in the pediatric glioma population. The adult glioma population had a mean fluorescence of 15.290 and a mean cell count of 57.6. These findings suggest a higher microglia cell count and activation rate in pediatric patients compared to adults.

**Mentor(s):** Susan Campbell (Neuroscience), Virginia Tech
Mrs. Katharine Davis, Blacksburg High School

**Jillie Alexander**
Virginia Tech/Environmental Resources Management

**Relic red spruce: Factors associated with current and future ecosystem conditions**

Our research is motivated by one primary question: what is the status and outlook of the relic red spruce population at War Spur in Giles County, VA? The project was designed to account for every red spruce tree over 4.5 feet tall within 100 yards of the War Spur Loop Trail. Geographic coordinates, diameter at breast height, and crown class were recorded for each tree. Additionally, a subsample of total heights was measured and used to build a predictive height model. We used these data to generate a diameter distribution, a stocking table, and a map showing the spatial distribution of the red spruce. From our results, we will be able to infer the outlook in this relic spruce population based on silvics for the species. The assessment of this population is significant to further our understanding of the tree species, which is regionally rare and generally found at higher elevations than that at War Spur.

**Mentor(s):** Corey Green (Forest Resources and Environmental Conservation), Virginia Tech

**Aun Ali**
Blacksburg High School/Advanced Studies

**GPUs vs. CPUs with Deep Neural Networks and Matrix Multiplication**

The rise of GPUs has created an environment where many think of GPUs as a panacea for computing scalability problems. However, GPUs may not always be able to deliver the promised performance. The results of this work will help establish whether the two studied classes of applications can truly benefit from GPUs, and thus provide for guiding future adoption of GPUs in that domain. The experiment defined two groups that would run two different tests, one group that would run benchmarks with CPUs only and one group that would run benchmarks with a CPU plus a GPU. These groups would run two different benchmarks both being measured in time to complete operation, these benchmarks running DNN and Matrix multiplication operations. I also established several hypotheses:

Null Hypothesis: The GPU will perform better on both the DNN and Matrix Multiplication tests

Alternative Hypothesis 1: The CPU will perform better on both tests then the GPU.

Alternative Hypothesis 2: The GPU will perform better on the DNN test and the CPU better on the Matrix Multiplication test.

Alternative Hypothesis 3: The GPU will perform better on the Matrix Multiplication test and the CPU better on the DNN test.

Results showed GPUs having time advantages in both tests. Suggesting that GPUs do in fact help performance in regards to time when it comes to DNN and Matrix Multiplication.

**Mentor(s):** Katharine Davis (Science), Blacksburg High School

**Ninie Asad**
Virginia Tech/Human Development

**Examining the Impact of a Storybook Series Designed to Strengthen Math Identity in Black and Latine Students and Students Experiencing Poverty**

Children's math identity, measured by beliefs about their math abilities, plays a critical role in math engagement and is linked to pursuing STEM careers. The Our Mathematical World curriculum overlay is focused on improving children's math identity, executive functioning, and math problem-solving skills, specifically targeting Black and Latine students and students experiencing poverty. One curriculum component was a storybook series featuring Black and Latine elementary-age children using math in their community. Book development involved input from scholars, educators, and students, and to further promote engagement from all students, they were translated from English to Spanish. As part of the curriculum implementation, teachers read each book during class. Afterward, students completed a survey about connections they made between the books' content/characters and their own lives, and how the book impacted their perception of themselves as a strong math learner. A total of 199 students in 3rd-7th grade provided a survey response for at least one book. We examined the following questions: Were students identifying as strong math learners also able to relate to the book characters? Are there grade-level or book-based differences in the types of connections made? We anticipate that students who made connections with the book were more likely to identify as a strong math learner and younger students would make more connections to themselves than other types of connections.

**Mentor(s):** Caroline Hornburg (Human Development and Family Science), Virginia Tech
Isabel Valdivia (HDFS Graduate Student), Virginia Tech

**Kathryn Athanasaw**
Virginia Tech/Psychology

**Anna Garban**
Virginia Tech/Psychology

**Weight Self-Stigma Predicts Eating Disorder Symptoms Among College Students Across One Semester**

Goals: College students are at high risk for eating disorders (ED). Weight self-stigma (WSS; internalization of negative beliefs about one's weight), is associated with ED, but it is unclear if higher WSS predicts future ED symptoms. We tested this across one semester.
Methods: Data were collected from n = 277 college students (75% female) at two timepoints (baseline = August 2022, follow-up = November 2022). Measures included the Eating Pathology Symptoms Inventory (to assess body dissatisfaction, binge eating, purging), Weight Self-Stigma Questionnaire, and weight/height to calculate body mass index (BMI). We conducted multiple regression models with EPSI subscales specified as the outcome and baseline WSSQ score, BMI, and gender as predictors. We controlled for the relevant ESPI subscale and body dissatisfaction at baseline.
Results: Baseline WSS ($p < .01$) and gender ($p < .001$) predicted follow-up body dissatisfaction ($p < .001$), controlling for baseline body dissatisfaction ($p < .001$) and BMI. Baseline WSS ($p < .05$) and gender ($p < .05$) predicted follow-up binge eating ($p < .001$), controlling for baseline binge eating ($p < .001$), body dissatisfaction, and BMI. Baseline WSS ($p < .01$) and gender ($p < .05$) predicted follow-up purging ($p < .001$), controlling for baseline body dissatisfaction ($p < .05$) and BMI ($p < .05$).
Conclusions: WSS at the start of the semester was associated with greater body dissatisfaction, binge eating, and purging at the end of the semester, especially among female-identifying students. Only purging was associated with BMI; students of all weight statuses may be vulnerable to this risk process. Addressing weight stigma on campuses may reduce or prevent ED.

**Mentor(s):** Heather Davis (Psychology), Virginia Tech

**Morgan Atkinson**
Virginia Tech/Biological Sciences

**Tensile Evaluation of the Vaginal Canal in Swine for Vaginoplasty**

The term transgender and gender diverse (TGD) refer to people whose sex assigned at birth does not align with their gender identity. In the United States, around 25% of TGD people undergo gender affirming surgery, such as vaginoplasty (James et al., 2016). Vaginoplasty aims to create an external vagina and/or a functional vaginal canal (Li et al., 2021). To provide adequate healthcare, tissues with similar mechanical properties to the native vaginal canal should be used. Our research focuses on characterizing the mechanical properties of healthy vaginal tissue in swine to compare it to scrotal and penile tissues. Swine were used as an animal model due to their anatomical, hormonal and histological similarities to the human vagina (Gruber et al., 2011). Strips of vaginal tissue (n=21) were excised in the circumferential direction (CD) from the vaginal canal of three swine. Instron E1000 Electropulse with a 50 N load was used to conduct uniaxial testing in the CD. Load-displacement data were used to calculate stress and strain; two mechanical qualities that serve to characterize the material behavior of vaginal tissue. The average normal strain of the proximal, medial, and distal regions were: 1.43, 1.32, and 1.02, respectively, at the maximum stress 5.4 kPa. A one-way ANOVA test showed an insignificant p-value of 0.261; meaning the difference in strain across anatomical regions is not significant. Future research includes testing human cadaveric tissue to introduce comparative analysis to penile and scrotal tissue.

**Mentor(s):** Raffaella De Vita (Department of Biomedical Engineering and Mechanics), Virginia Tech

**Grayson Barnes**
Virginia Tech/Biological Science

**The Roles of Spore Inner Membrane Lipids in Bacillus subtilis Resistance Properties**

Endospores are the most persistent life forms on Earth. These spores form as the result of nutrient depravation where they transcend into a state of dormancy. Metabolically inactive spores are highly resistant to a spectrum of environmental effects including high temperature and pressure, various chemicals, and radiation. Consequently, bacterial spores are important agents of food spoilage and life-threatening illness. To understand the resistant properties of these endospores, we consider the common soil bacterium Bacillus subtilis. The inner membrane of an endospore is highly impermeable contributing to the resistance properties demonstrated by spore forming bacteria. Previous studies from the Popham Lab have identified a list of genes suggested to be involved in lipid metabolism that are associated with the inner spore membrane. Mutating these genes could possibly highlight the changes that occur with lipid composition affecting membrane fluidity in the inner spore membrane. Our studies hope to find mutant spores that are less resistant to heat and have impairments in germination. Knowledge of such would contribute to spore killing. We intend to perform resistance assays to heat and hydrogen peroxide including a spore germination assay to better understand how these genes could modify the properties of the spore inner membrane.
Results showed that the lipid mutants exhibit a significant decrease in germination efficiency and an increase in doubling time. Meaning these mutants do not grow and transform into vegetative cells as efficiently as the wild type.

**Mentor(s):** David Popham (Biological Science), Virginia Tech

**Lauren Bartlett**
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**Christianna Johnsson**
Virginia Tech/Biochemistry

**Madison McMaster**
Virginia Tech/Biochemistry

**Comparison of the Binding Affinities of Fentanyl and a Derivative of Narcan in the MU Opioid Receptor**

Fentanyl is one of the most common opioid drugs used for pain relief and has very addictive qualities. We chose to use Fentanyl because it's involved in the opioid epidemic in the world currently and it has high death and overdose rates in the United States. The following experiment involved research into the binding affinity of a derivative of narcan as well as the binding affinity of fentanyl within the mu opioid receptor. The question of this research centered about whether the antagonist (narcan derivative) or agonist (fentanyl) had a more negative binding affinity and where this affinity was the strongest. To address this question, we first used Pymol to visualize the mu receptor protein. After all accessory proteins and structures were removed and the opioid protein was isolated, Webina was used to molecularly dock fentanyl compared to a derivative of narcan in the mu receptor. The narcan derivative, which acted as the control, was docked first, and the affinity was recorded. Then, the fentanyl ligand was docked and its affinity was recorded. After concluding the experiment, we found that fentanyl and narcan have equal binding affinities in the mu opioid receptor. The small difference of 0.3 in binding affinity was given due to the different preferred binding pockets for each ligand. Therefore, the antagonist and agonist of the mu opioid receptor have similar binding affinities and vary in where they dock in the receptor.

**Mentor(s):** Anne Brown (Biochemistry), Virginia Tech

**Ryan Baum**
Virginia Tech/Sustainable Biomaterials

**Influence of Materials and Manufacturing Method on Product Life Cycle Impacts**

Quantifying and improving the utilization of low life-cycle impact materials with high efficiency digital fabrication methods is essential to reducing the energy demands and environmental footprint of advanced manufacturing. Generalized life cycle impact metrics have been measured for many common materials; however, data and design methods are lacking to optimize the manipulation of materials using various advanced manufacturing methods. This research project uses a case study approach to quantify the life cycle impacts for a product design using different materials and manufacturing methods. A self-designed cageless roller bearing was fabricated utilizing 4 different materials made using both additive and subtractive manufacturing methods. Each case study approach is recorded to determine the embodied carbon, energy, material yield and other impacts of Polylactic acid (PLA) and Acrylonitrile Butadiene Styrene (ABS) for extrusion 3D printing and wood and aluminum machined using a 5-axis Computer Numerical Controlled (CNC) router. The purpose of this study is to compare the material and energy utilization efficiency of manufacturing methods, as well as compare the life cycle impact of different materials when applied to the various manufacturing applications. Results are expected to show that extrusion printing has the higher material utilization efficiency, CNC machining to be more energy efficient, and that the bio-based materials, wood and PLA, to have the lowest life cycle impact for their respective manufacturing method.

**Mentor(s):** Earl Kline (Sustainable Biomaterials), Virginia Tech

**Haley Bautista**
Virginia Tech/Water: Resources, Policy, Management

**Does water flow across the drainage divide of the Brush Mountain ridge?**

For this project, I observed and analyzed patterns of stage and conductivity in four streams on the north and south sides of Brush Mountain near Blacksburg, VA. Previous research identified more persistent streamflow and higher elemental concentrations in the stream water on the south side of the mountain. These observations, along with the dip of the underlying bedrock, suggest water may be flowing from the north to the south side of the mountain across the watershed divide. If this interbasin groundwater flow is occurring, there should be measurably higher concentrations of metal ions, and higher overall conductivity found in the south side water runoff due to weathering occurring along the flowpath. With interbasin flow, we would also expect to see longer recessions in stream conductivity after rainfall and less flashy overall responses in the south side watershed. To study these behaviors, synoptic water chemistry sampling was performed, and sensors were placed in two streams on each side of the mountain, measuring water level and conductivity. The sensors collected data every ten minutes for approximately one month. Preliminary data suggest that the north side streams have some higher elemental concentrations and specific conductivity than most of the streams on the south side. Conductivity responds quickly to precipitation and then recovers to pre-event levels in the same day on the north side, whereas it takes several days on the south side. While our initial data is promising, further evidence is needed to conclude that interbasin groundwater flow is occurring and contributing to streamflow.

**Mentor(s):** JP Gannon (FREC), Virginia Tech

**Grace Beaman**
Virginia Tech/Psychology

**Smartphone Use Explains the Relationship Between Home Chaos and Discipline Type**

There is evidence to suggest that frequent social media use is a mental health concern among adolescents and parents (Capri et al., 2019; Van Rooij & Schoenmakers, 2013). A major influence on this screen use is household chaos (Emond et al., 2018). Household chaos is defined as an environment that is disorganized and unstable (Matheny Jr., et al., 1995). It is possible that household chaos may strain family functioning, resulting in parents and children spending more time on the internet instead of interacting within family (Andrews et al., 2021; Godhino et al., 2014.) Therefore, the research question is how does household chaos relate to disordered social media use in parents and adolescents? I hypothesized that household chaos would be related to parental social media use, and therefore adolescent's social media use.
Using parent and self report questionnaire data from 122 participants at ages 9 and 13, a correlation analysis in SPSS showed household chaos was related to parent scales of disordered social media use, but not to adolescents' use. Based on this finding, we explored the potential relation between household chaos and parental discipline, mediated by parental disordered social media use. The mediation analysis was significant, and household chaos predicted more feelings of social media withdrawal in parents, which predicted more shame-related discipline practices [b = .108, BootSE = .065 , 95% CI: 0.008, .258 ]. These findings explain how social media use can influence discipline in a chaotic household.

**Mentor(s):** Martha Ann Bell (Psychology), Virginia Tech
Briana Ermanni (PSYC), Virginia Tech
Diana Devine (HDFS), Virginia Tech
Cynthia L. Smith (HDFS), Virginia Tech

**Brandon Bickley**
Virginia Tech/Biochemistry

**Extracellular electrophysiology in Drosophila melanogaster post transcriptionally silenced to reduce expression of the Type-B muscarinic acetylcholine receptor**

Continued control of insect pests amid their development of insecticide resistance necessitates the use of insecticides with varied modes of action. The cholinergic system, in which acetylcholine serves as an excitatory neurotransmitter in the central nervous system (CNS), has multiple components which are established insecticide targets. Unlike other components of the cholinergic system, muscarinic acetylcholine receptors have not been successfully developed as an insecticide target. Here, we investigated the physiology and pharmacology of the Type-B muscarinic acetylcholine receptor (mAChR-B) using extracellular electrophysiology in both wild type and silenced third instar Drosophila melanogaster larvae. Expression of the mAChR-B was reduced using the GAL4-UAS system to drive expression of an siRNA targeting the mAChR-B transcript (RNAi). In both wild-type and silenced D. melanogaster, 0.1 µM and 0.01 µM pilocarpine resulted in a decreased rate of firing in the CNS while 1 µM and 10 µM pilocarpine increased CNS firing. Knock down of the mAChR-B resulted in sustained neuroexcitation at 1 µM and 10 µM concentrations of pilocarpine and a longer time to reach maximum excitation at 1 µM pilocarpine relative to the wild-type. Ultimately, we hope to develop the mAChR-B as an insecticide target.

**Mentor(s):** Aaron Gross (Entomology), Virginia Tech

**Paige Bilski**
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**Michael Ko**
Virginia Tech/Biochemistry

**Charles Hamilton**
Virginia Tech/Biochemistry

**Aidan Coleman**
Virginia Tech/Biochemistry

**Milica Dukova**
Virginia Tech/Biochemistry

**Investigating the Effect of Residue Changes in the Binding Cavity of E. coli Glucokinase**

Glucokinase is an important enzyme in Escherichia coli, as it contributes to the phosphorylation of glucose. More specifically, it catalyzes the generation of glucose-6-phosphate by adding a phosphate group from ATP, making it ADP. Our study aimed to test how changing a residue would affect the binding affinity of glucose to the binding cavity of glucokinase. We focused on the ASP-100 (aspartic acid) amino acid and changed it to lysine (LYS) because ASP has an acidic side chain and LYS has a basic side chain. We wanted to see if changing the properties of the amino acid would change the binding affinity of glucose to glucokinase. We used PyMOL as a visualization tool and also as a mutagenesis tool to change the ASP-100 amino acid into LYS. We also used the software Webina as a molecular docking tool, first to perform redocking of the glucose into the original glucokinase, then to dock glucose into the modified glucokinase. We found that changing ASP-100 to LYS did in fact result in a slightly better binding affinity at -6.2 kcal/mol compared to the original glucokinase at -5.9 kcal/mol. This shows that this change results in better binding affinity.

**Mentor(s):** Anne Brown (Biochemistry), Virginia Tech

**Adam Bowen**
Virginia Tech/Psychology

**Kenza Kadiri**
Virginia Tech/PPE

**SWVA: Not Just Southern; Investigating Dialect Boundaries in Southwest Virginia**

The Appalachia Regional Commission splits Southwest Virginia (SWVA) into Central and South-Central regions. In the present study, we investigate whether residents of SWVA believe there are linguistic differences within the region, and our results suggest that SWVA (like parts of Eastern Kentucky (Greene 2010)) should probably be categorized as belonging to the Inland South dialect region (Labov, Ash & Boberg 2006:146).

To investigate perceptions of regional variation, we had participants sort place names into piles based on their perceived linguistic similarity (Tamasi 2003). Place names included a variety of towns in SWVA, but also smaller towns in bordering states, and large towns more clearly outside the region (i.e., Charlottesville). Participants were asked to explain their choices as they made the piles and were asked follow up questions.

At Virginia Tech, we recruited 21 people for the study who grew up in Southwest Virginia. We also collected data from 43 participants in more Western parts of the State.

A cluster analysis of the piles reveals that the primary split made by participants is between a group of relatively isolated mountain towns at or to the west of the Central and South-Central Appalachian boundary (e.g., Grundy, Tazewell) and all other towns. 9 participants explicitly referenced /ai/-monopthongization before voiceless consonants as a feature or the area, which is also the canonical Inland South feature (Labov, Ash & Boberg 2006:246). Also, many participants emphasized contrasts between general stereotypes of Southern speakers as slow and polite and a “fast”, “blunt” SWVA style.

**Mentor(s):** Abby Walker (CLAHS), Virginia Tech

**Dean Breeden**
Virginia Tech/Applied Computational Mathematics

**Nathan Padilla**
Virginia Tech/Political Science

**Dechlan Kuipers**
Virginia Tech/Digital Marketing Strategies

**Charles Hamilton**
Virginia Tech/Biochemistry

**Impacts of Artificial Intelligence on Manufacturing Companies in Virginia**

The recent growth of artificial intelligence (A.I.) technology will quickly begin to affect businesses and the area of commerce. As the understanding of A.I. increases so will its level of involvement in businesses across the globe. The integration of A.I. will correlate to the efficiency and success of business. Our research question is: 'What impact does the use of Artificial Intelligence and Machine Learning have on manufacturing companies in Virginia with respect to their efficiency and profitability?' We propose to collect data by interviewing/polling accredited economists, business leaders, and other related people in the manufacturing industry. The proposed research will dive into how A.I. is integrated into manufacturing companies in the state of Virginia, and the effects of technological advancements in the industry. We will explore the overwhelming ethical challenges that these companies will experience when attempting to implement A.I. technology. The outcomes we expect include a clear increase in efficiency and productivity when adopting A.I. technology further into manufacturing companies. The improvements companies will experience from introducing A.I. will be significant in comparison to pre-A.I. The expected ethical issues are: human rights, transparency, explainability, privacy, safety/security, and accountability. Another expectation is a higher involvement of A.I. policy in politics. The proposed research aims to provide valuable insights into the integration of A.I. technology in manufacturing companies in Virginia, including the ethical challenges and productivity improvements.

**Mentor(s):** Amanda MacDonald (Library), Virginia Tech

**Joseph Brown**
Virginia Tech/CMDA

**Johnathan Anderson**
Virginia Tech/SMA

**Bobby Verrier**
Virginia Tech/SMA

**Timothy Hipskind**
Virginia Tech/Political Science

**The Economic Impact of Hosting the Super Bowl**

The Super Bowl, the culminating event of the professional football season, has been one of the most widely viewed and revenue-generating sporting events in the world since its inception in 1967. The goal of this research proposal is to examine the question, to what extent does hosting the Super Bowl impact a cities' economy? To address this question we will analyze various sources in order to gain a better understanding of how the Super Bowl has affected its host cities and what factors indicate how successful a city will find hosting to be. These sources include comparisons between cost and profits of providing extra police force, EMT's, etc. and the amount earned directly from the NFL. They also would include a wide range of statistics, from increases in hotel costs to jobs created or lost. It is highly anticipated that the host city benefits from the amount of money the Super Bowl generates. However, there is the chance that hosting the Super Bowl could result in a negative outcome on the city,Äôs economy. As such, the research proposed from this study will help city planners and organizers decide whether or not their city should host the Super Bowl; potentially creating an opportunity for major economic growth as well as appeasing fans and businesses in the market.

**Mentor(s):** Amanda MacDonald (University Libraries), Virginia Tech

**Sam Buccarelli**
Virginia Tech/Human Nutrition, Foods, and Exercise (HNFE)

**Analysis of the FADS1 gene missense variants using in silico analysis to identify pathogenic variants in the human gene**

The Fatty Acid Desaturase 1 gene (FADS1) regulates desaturation of fatty acids (making them less saturated or unsaturated) by introducing double bonds in fatty acids carbon chains. Mutations in the FADS1 gene are implicated in altered cholesterol and fatty acid metabolism, leading to lipid metabolism disorders including obesity, atherosclerosis and fatty liver disease. The associated variants in FADS1 are not in coding regions of the gene, so it is difficult to know how these variants would affect FADS1 protein function. We are using in silico genetic analysis tools to identify and test pathogenic variants in FADS1 that are may cause these lipid metabolism disorders. Results from our mutation analysis, lipid binding, and 3D proteins analysis studies will be found. This study is part of a larger one that sought to identify fatty acid levels, and FADS1 genotype in VT Football linebackers.

**Mentor(s):** Deborah Good (Department of Human Nutrition, Foods, and Exercise), Virginia Tech
Shannon Mauro (Graduate Student), Virginia Tech

**Claudia Budzyn**
Virginia Tech/Environmental Policy and Planning

**Environmental Education in Kasane, Botswana**

The nonprofit organization, CARACAL, is dedicated to protecting wildlife and improving the livelihoods of communities through outreach projects, animal conservation efforts, and research aimed at a sustainable future. Environmental education enhances sustainability and biodiversity conservation in the Chobe District, Botswana. This educational program focuses on a two-tiered educational approach directed at strengthening the capacity of village youth. Delivering education modules and activities under training from CARACAL/VT staff will help enrich the environmental education experience among youth in Chobe schools. The curriculum covers ten modules ranging from improving waste management to habitat preservation. Through a combination of research, outreach, and education, the researcher works closely with local communities and the Botswana government to secure a sustainable future.

Working one-on-one and providing educational skills to the school district will impact the youth's learning. The Botswana school district schedules the school year by rotating between three terms. The first term begins January 12 and ends April 23; the second term begins May 11 and ends August 6; the third term begins August 24 and ends December 10. The researcher designated 3-4 units to be covered in each term. Students meet weekly on Wednesdays to learn an environmental lesson taught by the school teachers. Each lesson lasts an hour, where students learn about the topic and complete an activity supporting learned material. Outcomes will be measured by testing students' knowledge by asking questions before lesson introductions. After completing the activity, students will be asked follow up questions to determine how much they learned from the lesson. Progress can also be measured by class participation, engagement, and completion of the activity or experiment.

**Mentor(s):** Kathleen Alexander (Department of Animal and Poultry Sciences), Virginia Tech

**Vincent Bui**
Virginia Tech/Clinical Neuroscience

**In Vitro Analysis of a Novel PI3K Inhibitor as Cancer Treatment**

Phosphoinositide 3-kinase (PI3K) has been a major research focus due to its essential role in cancer growth and survival; however, targeting PI3K has failed to achieve promising clinical outcomes. This challenge pertains to the divergent role of the four PI3K catalytic subunits of glioblastoma. Recent research from our laboratory has shown that PIK3CB/p110β, but not other subunits, plays an essential role in glioblastoma (GBM). Selectide-18, a mimetic peptide that targets an 18-residue motif (β18) unique to PIK3CB/p110β, blocks the growth of glioblastoma cells in vitro/-in vivo and outperforms existing PI3K drugs; While Selectide-18 has been successful in previous studies, it has poor cell permeability due to its large size. With that, we recently reformulated Selectide-18 using residue sequence manipulation and found that K6 to Q14 provided the shortest formulation without significant declines in binding affinity; This new 9-residue sequence will be used to reformulate Selectide-18 in vitro. We hypothesized that our newly reformulated drug will be just as effective as Selectide-18 while being smaller in size. To test our hypotheses, we performed in vitro analyses using GBM cell lines and dosed them with our drugs: S-18 and K6Q14. Our results, using MTS cell proliferation assay, showed that K6Q14 was just as effective as S-18, yet smaller in size. Future steps include testing K6Q14 in different cell lines to see if our hypothesis still holds true. In conclusion, K6Q14 is a promising PI3K inhibitor that can be potentially used in xenograft rodent models in the future.

**Mentor(s):** Zhi Sheng (Internal Medicine), Virginia Tech

**Bridgett Burgos**
Virginia Tech/Clinical Neuroscience

**The Effects of Financial Stress on Depression and the Mediating Roles of Parental Behaviors in Mexican American College Students**

According to the Family Stress Model, economic pressure can affect parenting behaviors which can further affect youth outcomes (Conger et al.,2002). Previous research has supported these arguments; however, most studies were conducted in Western, Educated, Industrialized, Rich, and Democratic societies (Henrich et al, 2010). Thus, little is known about how financial pressures can influence parenting behaviors and youth outcomes in the Latinx community. The purpose of this study is to better understand the psychological processes and development of Latinx youth. Thus, this study examines how perceived financial stress is related to parental warmth and psychological control, which, in turn, is related to depressive symptoms in Mexican American college students. Participants were 214 Mexican American college students (Mage= 21.86 years; 77% female). Participants reported their financial stress using the College Stress Inventory, parenting behaviors using the Child Report of Parental Behavior Inventory, and depressive symptoms using the CES Depression Scale. Models were tested separately for mothers and fathers using path analysis in Mplus. Results showed that financial stress is positively associated with both maternal and paternal psychological control, which, in turn, is positively associated with depression. Financial stress is negatively associated with both maternal and paternal warmth, which, in turn, is negatively associated with depression. Overall, these findings showed that both parental warmth and psychological control can mediate the relations between financial stress and depression. These findings have important implications for the Latinx community in addressing the effects of financial stress on Mexican American adolescents' mental health and emotional well-being.

New teaser:
These findings showed that both parental warmth and psychological control can mediate the relations between financial stress and depressive symptoms.

**Mentor(s):** Zehra Gulseven (Department of Psychology), Virginia Tech

**Emma Callaway**
Virginia Tech/Microbiology - Biomedical

**Anne Craig**
Virginia Tech/Biochemistry

**Harper Wasserman**
Virginia Tech/Biochemistry

**Suzanna Long**
Virginia Tech/Biochemistry

**Audrey Prendergast**
Virginia Tech/Biochemistry

**Exploring New Ligands to Combat Antibiotic Resistance in M. Tuberculosis Beta-Lactamase**

Antibiotic resistance in Mycobacterium tuberculosis (M. tuberculosis) is a growing issue. Antibiotic resistance is often caused by overuse and misuse of antibiotics, causing bacteria to develop ways to break down antibiotics. In the case of M. tuberculosis, the enzyme beta-lactamase breaks down the beta-lactam ring in antibiotics such as Ceftriaxone. The prevalence of antibiotic resistance in M. tuberculosis calls for a new antibiotic treatment. Using molecular visualization and molecular docking techniques to alter the antibiotic ligand from Ceftriaxone to Cephalothin (same class antibiotics), the binding affinity differences were tested to further evaluate the subsequent antibiotic resistance. Binding affinity at the active site that is less negative is less likely to experience hydrolysis of the beta-lactam ring, providing an antibiotic less susceptible to antibiotic resistance. We found that Cephalothin had a less negative binding affinity which indicates that Cephalothin may be a more effective antibiotic to treat M. tuberculosis. Using Cephalothin as an alternate antibiotic against M. tuberculosis provides a possible treatment for those infected with antibiotic resistant tuberculosis. This has implications worldwide, and further research can be done to find if Cephalothin is a more effective treatment in clinical trials.

**Mentor(s):** Anne Brown (Biochemistry), Virginia Tech
Valerie Ballard (Department of Biochemistry), Virginia Tech

**Hannah Cannon**
Virginia Tech/Biochemistry

**Molecular Basis for the Interaction of Phafin2 with the Actin Network During Macropinocytosis**

Macropinocytosis is a vesicle-mediated process to allow the uptake of extracellular molecules and fluid. Recently, the protein Phafin2 has been shown to be involved in macropinocytosis at different steps, which depend upon its interaction with both phosphoinositides and the actin network. Phafin2 is modular with two phosphoinositide-binding domains, the PH and FYVE domains. During macropinocytosis, the PH domain binds both phosphatidylinositol 3-phosphate and phosphatidylinositol 4-phosphate, whereas the FYVE domain is specific for phosphatidylinositol 3-phosphate. Additionally, macropinocytic vesicle maturation depends on the actin network. Due to the requirement of actin, actin-associated proteins also play an important role in macropinocytosis. One of the actin network components, the cross-linking protein Filamin A, has been shown to interact with Phafin2, via its PH domain, in cell-based experiments. To characterize this association, we isolated the recombinant Filamin A Phafin2-binding region (PBR; residues 186-368) by conventional protein purification procedures. Using isothermal titration calorimetry, Filamin A PBR bound Phafin2 exothermically with a dissociation constant of 1.08 ± 0.40 uM, stoichiometry of 1, and a Gibbs free energy of -34.1 KJ/mol. We have obtained the NMR resonance assignments of the Phafin2 PH domain, which will allow us to identify the Filamin A PBR binding site in the Phafin2 PH domain. Given that this domain binds phosphoinositides, we also plan to explore the hypothesis that the binding of Filamin A to Phafin2 increases the affinity for phosphoinositides to proceed with the macropinocytosis process.

**Mentor(s):** Daniel Capelluto (Biological Sciences), Virginia Tech

**Anna Cappellina**
Virginia Tech/Dairy Science

**The effect of intercropping legumes with grasses on the fiber ruminal digestion kinetics of the forages.**

The objective of this study is to determine the effect of intercropped legumes with grasses on ruminal digestion rate (k) of neutral detergent fiber (NDF) and the undegraded NDF (uNDF). There are 5 grasses, which include barley (BA), ryegrass (RG), rye (RY), triticale (TT), and wheat (WT) and 2 legumes, crimson clover (CC) and hairy vetch (VE). There will be 20 plots of monoculture (NO) grasses, grasses with CC, and grasses with VE grown at 1 site (Blacksburg, VA). These mixes will be fresh (F) or ensiled (S). All plants are to be harvested by hand with a hedge trimmer, weighed to determine dry matter yield (DMY), chopped, bagged, and frozen in the field. All samples will be dried and ground (1-mm screen) before crude protein (CP), NDF, starch, and in situ digestibility analyses. A total of 960 samples will then be inserted into porous filter bags and incubated in the rumen of two lactating Holstein cows for 0, 3, 6, 12, 24, 48, 96, and 240 hours. The digestion rate of NDF and the uNDF concentration will be determined using the NONLIN procedure of SAS. The statistical model for contrasting k and uNDF will include the fixed effects of type, treatment, and all the possible interactions, the random effect of block, and the random residual error. The digestibility of ensiled forages was greater than that of fresh forages. Monoculture grown forages decreased k relative to CC and VE for all grasses except S RG. In conclusion, growing grasses mixed with legumes lowered fiber digestibility in F mixes but intercropping grasses with CC had the highest fiber digestibility in S mixes.

**Mentor(s):** Gonzalo Ferreira (Dairy Science), Virginia Tech

**Jack Carroll**
Virginia Tech/Environmental Policy and Planning

**Rural-Urban Bias In Large Language Models Using Spatial Analysis**

As large language models (LLMs) and generative artificial intelligence have become more accessible, there is a need to find new uses for them and examine potential biases within them. Our research explores how much of our spatial reasoning is captured in language. LLMs, such as Open.AI's ChatGPT application, are trained on billions of existing words that have co-occurred in web documents, academic articles, and digitized print media, essentially operating as a super-powered auto-complete. However, the current generation of LLMs do not incorporate non-language-based logic of mathematics or databases that might enable network-based reasoning. Therefore, spatial reasoning should only be based on the probability of space-based language co-occurrence as proxies for spatial measurements, such as distance. Given that rural areas are less written about than urban areas, we hypothesize that ChatGPTwill be less accurate in its output distances between rural points. In order to test this, we used McDonald's addresses across the state of Virginia as our points. We then had ChatGPT answer distance questions. We analyzed the results to see if the answers were more or less statistically accurate compared to the true Euclidean distance between the points. This allows us to know if there is potential bias within the data the model is fed. If large language models have lower accuracy within rural areas, they will need to be adjusted to account for it.

**Mentor(s):** Theodore Lim (SPIA), Virginia Tech

**Rachel Castro**
Virginia Tech/Cognitive and Behavioral Neuroscience

**PREDICTORS OF ADHD SYMPTOMS IN MIDDLE CHILDHOOD**

Cognitive processes are impaired in ADHD. Issues with attentional control (AC) are a core symptom of ADHD and these difficulties are often present before the age of 12 (NIMH, 2022). Evidence also suggests that groups with ADHD show impairments in inhibitory control (IC) tasks (Alderson et al., 2007). Additionally, studies show that externalizing traits (EXT) in middle childhood can predict ADHD symptoms in early adolescence (Kuja-Halkoka et al., 2015). We assessed whether child AC, IC, and EXT at age 6 predicted for ADHD symptoms at age 9 in a community sample.

Child AC was measured using a modified version of the NEPSY subtest (Epsy & Amp; Bull, 2005). Child IC was measured using caregiver reports on the IC scale of the CBQ (CBQ-SF; Putnam & Rothbart, 2006). Externalizing behavior and ADHD symptoms were measured on the CBCL (Achenbach & Rescorla, 2000). A hierarchical regression analysis with sex controlled for in step 1 and the inclusion of AC, IC, and EXT in step 2 for predicting ADHD symptoms was conducted. The final step (R 2 =.417, F=34.992, p<.001) showed that child AC (beta= -.115, p=0.38), child IC (beta = -.377, p<.001), and child EXT (beta = .252, p<0.01) at age 6 were significant predictors of ADHD symptoms at age 9. Results indicate that lower levels of AC and IC respectively along with greater externalization predict for later ADHD symptoms. Findings suggest the importance of cognitive and temperamental factors as predictors for future ADHD behaviors.

**Mentor(s):** Martha Ann Bell (Psychology), Virginia Tech

**Tina Choi**
Virginia Tech/Chemistry

**Virginia Babcock**
Virginia Tech/Civil Engineering

**Maude Focke**
Virginia Tech/Environmental Science

**Sustainable Materials**

Lumber is one of the most common renewable building materials, but lumber harvesting contributes to deforestation and it takes about 20 to 30 years for lumber-harvested old-growth trees to regrow. Also, synthetic lumber, the leading solution on the market, is not recyclable and often has greater expansion and contraction rates than traditional lumber. With the increasing awareness of sustainability, we focus on finding a suitable material to replace structural lumber, primarily used for decking. Over the past two semesters, we have been performing literature review and gaining information about the components of wood, different types of wood, and how different types of lumber are created. We have performed microscopy on multiple wood samples and were able to obtain very in-depth pictures of wood structures. We eventually would like to analyze samples of wood showing us how the structural components interact and give the wood its specific characteristics. Once we can see how these components interact, we plan on producing a prototype on which we can conduct tests examining strength, environmental impacts, and commercial use. Once the product reaches its functional lifespan, the product will be able to either be recycled, composted, or reused. Our ultimate goal is to make a sustainable and commercially replicable product that will be used in place of lumber.

**Mentor(s):** David Gray (Engineering Education), Virginia Tech

**Caoilainn Christensen**
Blacksburg High School/Advanced Studies

**Comparative Content and Engagement Analysis of Credentialed and Non-Credentialed Nutrition Professionals on Instagram**

With the relatively unregulated nature of social media, any accounts following the platform's guidelines can provide medical information. Nutrition information, specifically, is shared by both credentialed and non-credentialed nutrition professionals. This information warrants the question: what are the major content and engagement differences on Instagram between registered dietitians and nutritionists and nutrition professionals without a registered nutrition license? Although there has been research comparing these two groups, most of the research has focused on Twitter and blog posts (Titova et al., 2022). Content from different platforms serve different purposes and come in different formats (Pelletier et al., 2020). To study these groups on Instagram, two populations of ten accounts each were selected to be compared. The five most recent posts were used to find the themes and engagement. The captions, like counts, and comment counts were collected. Through the content analysis software NVivo, the captions of each group were coded into the most common content themes. From the credentialed population, the themes fell largely under the categories of emotions and mind-body connection. From the non-credentialed populations, the themes fell largely under the category of science-based strategies. Additionally, the credentialed population had higher mean like and comment counts compared to the non-credentialed population's mean like and comment counts. It was concluded that the credentialed population's content revolved more around emotions and had higher engagement while the non-credentialed population's content was more focused on science-based claims.

**Mentor(s):** Katharine Davis, Blacksburg High School

**Amber Clauss**
Virginia Tech/Industrial and Systems Engineering

**Identifying Skill Gaps Between University Programs and Related Careers with a Focus on Industrial and Systems Engineering**

Universities are continually seeking out paths to provide the most relevant workforce skills to students. Often, selecting a major helps students determine refined skillsets for various career paths, but as industries evolved, degree programs selected by students haven't always aligned with what students are expected to do in their careers. In addition, there aren't always standard or centralized resources defining these broad programs and their career paths. This project seeks to map skill clusters from comparable Industrial and Systems Engineering (ISE) university programs, and related industries, to potential skill gapping. We hypothesize that by aligning university and industry skillsets & comparing similarities and gaps, we'll be able to inform students' career decisions. To answer this, preliminary university and industry skill data selection, validation, bias correction, and analysis methodologies were derived. American universities that were both R1 research institutions and had ABET-accredited ISE programs were considered comparable. To determine university skills, common words across the comparable universities required curricula will be collected. Using top occupations data from Labor Insights, LinkedIn Industry and Skill Reports will be used to determine industry skill clusters. Finally, both skill clusters will be compared for correlation clustering. Analysis of skill cluster and correlation outputs will be used to denote which skills aren't commonly taught, their omission's potential impact, and then disseminated to ISE career professionals via visualizations and reports. These conclusions will be used to establish a need for centralized resources, determine the nuanced differences in university programs, and outline the value of ISE programs.

**Mentor(s):** Anne Brown (University Libraries, Biochemistry), Virginia Tech
Jonathan Briganti, Virginia Tech

**Bailey Connors**
Virginia Tech/Environmental Horticulture

**Does edge proximity impact thermal tolerance of Solenopsis invicta**

Increasing habitat fragmentation due to anthropogenic land use leads to landscapes with altered thermal environments. Solenopsis invicta (red imported fire ant) is an invasive and widely occurring ant species found in the southeastern United States. Previous studies have shown that dominant ant species are more sensitive to changes in temperature compared to their subdominant species. Fragments of longleaf pine savanna have higher temperatures in patch interiors rather than along the shady edges, due to more heat tolerant ant colonies being selected in the center, and less heat tolerant ants being selected for the edge. To test this hypothesis, we measured the critical thermal maximum of Solenopsis invicta workers from ant colonies at edge and interior locations within fragments of restored longleaf pine savanna (N = 10) surrounded by dense loblolly pine plantations. We detected no differences in CT maximum in S. invicta between edge and interior colonies, suggesting that S. invicta workers are not changing their thermal tolerance as a function of edge proximity. It is possible that habitat fragmentation is affecting S. invicta in other physiological ways; but the increasing temperature gradient between edge and interior does not seem to have a direct threat to the species' survival. The implications of these results suggest that in spite of their thermal tolerance, S. invicta is still apt to be the dominant ant species in their invaded range.

**Mentor(s):** Melissa Burt (Department of Biological Sciences), Virginia Tech

**Annabel Coyle**
Virginia Tech/Biology

**House Finch Innate Immune Responses Vary with Ambient Temperature as Indicated by Haptoglobin**

Some pathogen infections are more likely to occur at cold temperatures. The effects of temperature on a host's immune response might offer a basis for increases in susceptible populations during the winter. In this project, we studied one aspect of the innate immune responses to Mycoplasma gallisepticum infection, haptoglobin concentrations ([hp]), to understand the trade-off between immunological and metabolic pathways in house finches. Birds were held at neutral (room) temperatures or at cold temperatures similar to those they experience in winter. After collecting plasma samples, [hp] absorbances were determined using Tridelta Developed Ltd. Haptoglobin Assay. Actual concentrations were calculated with standard curves. We asked, what is the relationship between temperature and [hp], and does individual variation offer a better view of this relationship? It is hypothesized that there will be a significant difference in [hp] of experimental groups held at cold stress temperatures versus neutral temperatures. Preliminary results indicate birds held at cold temperatures have a higher baseline and post-inoculation [hp] than thermoneutral birds.

**Mentor(s):** Dana Hawley (Biological Sciences), Virginia Tech
Jesse Garrett-Larsen (Biological Sciences), Virginia Tech

**Abigail Craig**
Virginia Tech/Cognitive and Behavioral Neuroscience

**Rebecca Gregory**
Virginia Tech/Human Development

**Administrators' Perceptions of Family-Based Treatment Barriers and Facilitators for LGBTQ Youth with Suicidal Ideation and Behavior**

LGBTQ youth have significantly higher rates of suicidal ideation and attempts compared to their cisgender, heterosexual counterparts (Haas et al., 2011; James et al., 2016). Few treatments are developed and adapted to address suicide in this population (Russon et al., 2021). Attachment-Based Family Therapy (ABFT), which focuses on engaging caregivers in psychotherapy, not only shows promising results in treating suicidal youth, but is one of the only models that has been adapted for this population (Diamond et al., 2012; Diamond et al., 2019). Unfortunately, this treatment has yet to be incorporated in community-based settings. When putting empirically-supported treatments in place, it is important to work with the stakeholders in these settings. This early-stage qualitative study engaged administrative stakeholders to examine implementation barriers for putting ABFT in their community-based settings. Administrators (n = 11) were interviewed to discuss the barriers and facilitators in implementing ABFT. Transcripts were analyzed through qualitative coding and thematic analysis (Braun & Clark, 2006). Results revealed 10 needs, 12 facilitators, and 9 barriers related to suicidality and treatment of LGBTQ youth. Findings illustrated the issues concerning ABFT, particularly concerning the engagement of families. Identifying needs, barriers, and facilitators associated with ABFT in this population may lead to greater access and increased quality of care for LGBTQ youth.

**Mentor(s):** Jody Russon (Human Development and Family Science), Virginia Tech

**Joshua Crocker**
Virginia Tech/Aerospace Engineering

**Jessica Koks**
Virginia Tech/Aerospace Engineering

**Michael Chiou**
Virginia Tech/Mechanical Engineering

**Ben Koniers**
Virginia Tech/Mechanical Engineering

**Irene Johns**
Virginia Tech/Mechanical Engineering

**Katie Hucker**
Virginia Tech/Statistics

**AutoPlane**

Aerial photography and surveying have become staples in modern life thanks to the rapid advancement of consumer / commercial UAS and highly customizable payloads. On AutoPlane, we aim to explore the technical challenges behind this emerging technology by designing, building, and testing our own system for aerial surveying. We are currently working on a 9 ft fixed-wing endurance drone, while also developing a low-cost multispectral camera as an independent payload. The drone and payload will work in tandem to fly predetermined routes and automatically photograph targets of interest. We are currently in the early testing stages of both the drone and payload, and we have been conducting short flights to collect data on the drone's performance. Our current goal is to demonstrate that the drone is capable of flying automatically without a payload, and that our payload camera can be triggered remotely and consistently. In the coming year we plan to refine both the drone and payload in order to perform consistent and regular data collection flights, while continuing to explore the practical applications of our system. As both systems mature, one exciting application is in agriculture and forest management, as multispectral data can measure characteristics such as soil moisture, surface heating, and foliage type.

**Mentor(s):** David Gray (ENGE), Virginia Tech

**Morgan Crum**
Virginia Tech/Wildlife Conservation, Human Dimensions Option

**Utilization of Stormwater Retention Ponds in Blacksburg and Christiansburg, Virginia by Frogs and Toads**

Stormwater retention ponds intercept and often store runoff from impervious surfaces. These ponds reduce flooding while filtering and retaining pollutants, such as metals from car brake wear, before water returns to streams. Most states and municipalities require retention ponds for commercial and residential developments to minimize the impact of runoff on streams. Some have suggested that stormwater ponds could serve as valuable wildlife habitat in suburban and urban environments. However, pollutants could reduce their usefulness to wildlife. We surveyed stormwater retention ponds in the towns of Blacksburg and Christiansburg, Virginia, to document amphibian populations while measuring conductivity related to road salt contaminate runoff. Our preliminary results from only a few weeks into the amphibian breeding season show amphibians utilizing retention ponds as breeding sites. We have also noticed frogs choosing ponds with lower conductivity in situations where ponds are located close to each other.

**Mentor(s):** Kevin Hamed (Fish and Wildlife Conservation), Virginia Tech
Brandon Crawford (Fish and Wildlife Conservation), Virginia Tech
Joel Snodgrass (Fish and Wildlife Conservation), Virginia Tech

**Brice Crum**
Virginia Tech/Biological Sciences

**Terrible roommates: Invasive crayfish serve as incompetent surrogate hosts for native symbionts.**

Symbiosis is integral to the life history of many organisms. In the last two decades, there has been considerable research to understand the relationship between crayfish and their symbiotic annelid worms. We sought to understand how this symbiotic relationship functions under the influence of invasive crayfish species. We hypothesized that the invasive species would possess lower amounts of symbionts. To accomplish this, we surveyed 32 sites in an Urban Stream in Montgomery County, Virginia, and obtained ten crayfish with a carapace length of at least 20 mm in length at each site. We found that the introduced Faxonius cristavarius dominated our stream community making up 55% of the observed crayfish, but on average, harbored a very low amount of symbionts compared to native species within the creek. Cambarus appalachensis and Cambarus Bartonii were the only native species found within the creek and contained the highest amount of symbionts. Our hypothesis was supported and we explained this by accounting for F. cristavarius' heightened symbiont grooming behavior compared to native species. The almost total lack of symbionts on F. cristavarius is supported by the literature, with F. cristavarius being observed to groom off symbionts at densities of one, compared to native species which groom at densities of 10. These findings are significant and reinforce laboratory studies demonstrating that F. cristavarius may harbor significantly fewer symbionts than native crayfish species. Further studies should seek to understand if suboptimal hosts are decreasing overall symbiont abundance within a stream community.

**Mentor(s):** Bryan Brown (Biological Sciences), Virginia Tech

**Kalin Davis**
Virginia Tech/Wildlife Conservation

**American Black Bear Foraging Patterns Potentially Alter Central Appalachian Flora Through Consumption and Spread of Invasive Species**

Invasive plant species can outcompete native plant species that wildlife rely on for food and cover. Three invasive species are a concern for the Virginia Department of Wildlife Resources (VDWR): wineberry (Rubus phoenicolasius), autumn olive (Elaeagnus umbellata), and oriental bittersweet (Celastrus orbiculatus). Wineberry is of particular interest because it resembles native plants such as blackberry (Rubus fruitcosus) and red raspberry (Rubus idaedus) and has the ability to outcompete them. In this study, we analyzed 15 (7F, 8M) American black bears (Ursus americanus) equipped with video and GPS-enabled collars in 2018 and 2019 to understand diet composition, especially for invasive plant species. We recorded bear foraging and eating behaviors, including the locations where plants were consumed. We compiled locations and created heat maps in ArcGIS to emphasize which areas were hot spots for invasive species consumption by bears. Of the data from 15 bears analyzed so far, nine consumed invasive species, but primarily at low levels. However, one female and one male had a high proportion of their diet that consisted of invasive species (58.8% and 65.8%, respectively), indicating that certain individuals in a population may be responsible for the majority of the invasive species spread across the landscape (i.e., super-spreaders). Additionally, our comparative analysis between 2018 and 2019 showed an increase in the consumption of invasive species between survey years. We pinpointed which bears and where on the landscape they were eating invasive species. This information is valuable to VDWR as they manage wildlife and work to address the growing threat of invasive species populations across the state.

**Mentor(s):** Marcella Kelly (Fish and Wildlife Conservation), Virginia Tech
Brogan Holcombe (Department of Fish and Wildlife Conservation), Virginia Tech

**Allison Deaton**
Virginia Tech/Computer Science

**Minecraft as a tool for exploring and learning ecology in the built environment**

In this work, we evaluate the potential of Minecraft for use as a simplified visual modeling system for urban ecology in education. We begin by mapping common elements in the game to common elements in real life, including building elements and living things. We then conduct a learning exercise with undergraduate students, who are asked to consider the lives of non-domesticated animals living in and around houses, and then build representations of their lives in Minecraft. Using pre- and post-surveys, we evaluate the impact of the exercise on how the students think about buildings, peridomestic animals, and the shared built environment. We also examine the Minecraft builds for accuracy and complexity, to evaluate student efficacy in representation of buildings and urban ecology. Our results provide a repeatable generalized method for producing representations of ecosystems in Minecraft, including a list of mobs and agents with corresponding animals, plants, and building materials. They also demonstrate and assess a learning activity that uses Minecraft to help students conceptualize and build these representations.

**Mentor(s):** Benjamin Deaton (Department of Engineering Education), Virginia Tech

**Jonathan Distler**
Blacksburg High School/Advanced Studies

**Observed Differences Among White-Tailed Deer Populations in Private and Public Land**

White-tailed deer (Odocoileus virginaus [deer]), are an overabundant keystone species. As a result, they cause many ecological problems throughout the eastern United States, including a loss of biodiversity. Hunting has been identified as the most effective method to return deer populations to a reasonable population size. Private and public hunting have different durations and access to hunting. So, what are the behavioral differences between deer on private and public land? The goal of this research was to compare behavioral differences between deer on private and publicly hunted land. For the research project, four game cameras were placed throughout Giles County, Virginia: two on privately owned land; two on publicly owned land in the Jefferson National Forest. The cameras were outside for eight days and photographed the population dynamics of the deer. The average herd contained 2.1 deer, with 26 does and 3 bucks and a range of 29:3 or 26:6 does to bucks ( some genders could not be discerned). The deer's most frequent activity was foraging, and they were most active during dusk (6:00 PM-8:15 PM). For the publicly owned land plots, there were no visible deer, therefore, no comparison could be made. As a result of this study, it was determined that privatized hunting resulted in no behavior change compared to typical herd statistics during the same period. With the Virginia Deer Management Plan ending in 2024, these results can provide evidence to legislators for maintaining the current privatized hunting model as it allows for a population reduction while maintaining similar deer behaviors.

**Mentor(s):** Katharine Davis (Science Department), Blacksburg High School

**Fiona Dreesbach**
Virginia Tech/Microbiology

**Julianna Diodato**
Virginia Tech/Neuroscience

**Derek Wodotinsky**
Virginia Tech/Physics

**Cheolhoon Park**
Virginia Tech/Physics

**CREDO: The Influence of Location on Average Number of Cosmic Ray Detections**

The cosmic ray extremely distributed observatory (CREDO) is a worldwide science experiment that began in 2016 aimed at understanding more about cosmic rays. Our study used the CREDO smartphone app to detect cosmic rays, which was then transmitted to the CREDO website to add to cosmic ray knowledge. By utilizing many smartphones to make detections, the need for a large, resource-heavy detector is no longer necessary. We sought to analyze differences in detections from inside and outside of buildings. To record detections, an object blocking out all ambient light was placed over the smartphone screen after opening the app. From there, the app records pictures of the cosmic rays as well as various physical data about the rays such as time, azimuth angle and hit position. We discovered that recurrence of the cosmic rays, the hit position, and azimuth angle of the cosmic rays did not have an identifiable pattern when compared between data recorded outside versus inside. There were also no statistically significant differences in recurrence in cosmic rays per second. We concluded that since cosmic rays originate from outer space, being indoors and outdoors does not impact the hit position and azimuth angle. Based on the results of the timing, the regularity of detections per minute did not have any obvious discrepancies when taken indoors or outdoors. This supports previous research that cosmic rays are rarely, if ever, prevented from reaching the Earth by solid matter.

**Mentor(s):** Temperance Rowell (COS), Virginia Tech

**Lindsay Dressel**
Virginia Tech/Geography

**Tyna Hesser**
Virginia Tech/Geography

**Seeing Heat in 3D: Multisensor Integration for Comprehensive 3D Thermal Mapping and Modeling**

Thermal imagery has previously been focused on improving 2D visualizations of heat in urban areas to better communicate how land cover impacts heat emissions. To better understand the impacts of building fa√ßades on heat emissions, we developed 3D fully interactive thermal models. During this project, we compared the outputs of three different camera types and resolutions, the FLIR One, FLIR Duo Pro R, and FLIR Vue Pro R to understand what quality of camera is required to effectively model the thermal fa√ßade of buildings. Additionally, we experimented with using different sources for the physical models of buildings, including terrestrial and drone Structure from Motion, and the use of secondary sources such as aerial lidar. Flights used Real Time Kinematic GPS positioning for Ground Control Points, and Pix4D software was used to reconstruct the 3D environment from the images.

These 3D models will form the basis for a future user study in which they will be assessed for how well they improve users' learning about the thermal properties of a location compared to more traditional thermal orthoimagery.

**Mentor(s):** Thomas Pingel (Geography), Virginia Tech

**Emma Dunn**
Virginia Tech/Fashion Merchandising and Design

**Christian Aunapu**
Virginia Tech/Political Science

**Benthany Fernandez**
Virginia Tech/Construction Management

**Jackson Wilcox**
Virginia Tech/Advertising

**Investigating Fast Fashion: Analysis of Inhumane Working Conditions in India, Bangladesh, and Thailand**

There has been an uproar in fast fashion trends over the last decade, and the call for innovative cost-saving methods increased. Globalization has put a stress on the fashion industry to create products for cheaper in order to sell for cheaper. Our research proposal is centered around the infamous conditions these fashion industry workers face and the integrity of the “preventative” regulations. Our proposed research question is: How do fad trends affect inhumane working conditions in the fashion industry, specifically in India, Bangladesh, and Thailand? Our proposed methods would be surveys and interviews with employees and higher-ups in fashion production factories in named countries. This proposed data collection will assess the effectiveness of existing regulations meant to protect workers, working conditions and treatment in the garment industry as demand increases. The surveys and interviews would be expected to expose the working conditions of fast fashion labor in foreign countries, such as hours and compensation. They would also expectedly show the exploitation of workers committed, and loopholes found, by major companies despite loose regulations in place. There are several legal acts in place to help protect workers’ rights in the fashion industry, which have worked in some situations while ineffective in many countries. The purpose of this research proposal is to examine areas lacking in protective workers’ rights in the current market. This problematic effect of globalization is increasing and a stronger legal framework needs to be implemented in order to create safe working conditions for workers’ across the globe.

**Mentor(s):** Amanda MacDonald (Library), Virginia Tech

**Tiffany Duong**
Virginia Tech/Microbiology

**Assessment of the bacterial microbiome on Virginia amphibians across life stages**

The host-associated bacterial communities that develop on amphibians influence host health and development in a variety of ways. There are many factors that contribute to bacterial establishment on host amphibians, including developmental changes in host physiology during hatching and metamorphosis. While prior research has noted variation in bacterial microbiome composition across developmental stages for some amphibians, the specific nature of these changes is still poorly understood in many amphibian species. This study aimed to understand the natural bacterial communities found on cohabitating frog species, building a better foundation for amphibian microbiome research. Using 16S rRNA gene amplicon data from whole body amphibian samples, we analyzed bacterial microbiome composition across amphibian species and life stages in natural or semi-natural habitats. We observed that as host species developed, the composition of the bacterial communities varied, suggesting that the physiological changes that occur during hatching and metamorphosis impact bacterial community composition. Additionally, differences in community composition were seen between different species within the same developmental stage, suggesting that individual species identity also plays an important role in bacterial recruitment or selection.

**Mentor(s):** Lisa Belden (Biological Sciences), Virginia Tech

**Elizabeth Eroshenko**
Virginia Tech/Environmental Science

**Does Biochar Make Sandy Soil More Sticky**

The objective of this project is to examine how two types of biochar influence short-term changes in soil physical and biological properties. Biochar, lightweight organic material, is often considered as a potential soil amendment in agriculture to improve soil health and increase crop yields. However, the short-term impact of biochar on soil physical, chemical, and biological parameters has not been widely studied. To address this gap in knowledge, sandy soil samples were amended with 0.5% of grass-based biochar by weight of the soil and allowed to incubate at 25°C for 30 days. Following the incubation period, soil aggregate stability (soil physical property) and microbial production of extracellular polymeric substances (soil biological property) were measured and compared to the unamended soil samples. EPS are “sticky” substances produced by soil microorganisms and are primarily composed of polysaccharides and proteins. Soil water holding capacity and pH were also measured before and after the incubation period. Preliminary results show that adding 0.5% of biochar by weight of the soil immediately increased the soil pH from 5.5 to about 6.4 - 6.8. We expect soil pH to remain elevated in biochar-amended soil samples following the incubation period. In addition to pH, we expect biochar-amended soils to have higher water holding capacities, increased aggregate stability, and more EPS compared to the unamended soil samples. This project will advance our knowledge on how quickly biochar can influence soil properties and provide critical information for researchers looking to use this biochar as an amendment in agricultural settings.

**Mentor(s):** Brian Badgely (School of Plant and Environmental Sciences), Virginia Tech
Daniel Smith (School of Plant and Environmental Sciences), Virginia Tech

**Kennedy Farmer**
Virginia Tech/Wildlife Conservation

**Investigating ocelot interactions with camera traps as a source of bias in density estimation**

Camera trapping is a widely used method of observing large, elusive mammals to study population ecology and monitor population densities. Animals often interact with cameras, even when camera traps are not baited. While it is well-established in the capture-mark-recapture literature that learned responses (e.g. trap-happy or trap-shy) can bias abundance and density estimates, little consideration has been given to whether such interactions with noninvasive detectors could also indicate a type of learned response. Anecdotally, researchers have described wild felids as curious, repeatedly visiting camera traps after the first “capture”. We quantified frequency of ocelot (Leopardus pardalis) interactions with camera traps to examine potential influence on population estimates. We reviewed 1186 ocelot photo-captures over 2 years (2016-2017) from camera trap data across 4 different study sites in Belize, Central America, and identified 310 instances of camera interactions. We recorded the type of ocelot interaction with cameras (e.g., looking/passive, looking closely, sniffing, or rubbing), sex, and time of day. We also identified individual animals through their distinct coat patterns. We found there were more female individuals detected than males. Most interactions occurred at night, but that is also when the majority of detections occurred, since ocelots are mainlynocturnal. We used logistic regression to determine the influence of camera location, individual ID, sex, and time of day as possible predictors of interactions and to test for differences by time.
Our study could be replicated with other species studied with camera traps to identify potential sources of bias due to camera interactions.

**Mentor(s):** Marcella Kelly (Wildlife Conservation), Virginia Tech
Rob Nipko (Wildlife Conservation), Virginia Tech

**Nathan Ferguson**
Virginia Tech/Wildlife Conservation

**Assessment of Microplastic Contaminants Between Native and Invasive Crayfish Across Various Levels of Habitat Degradation**

Microplastics, commonly categorized as particles <5 mm in diameter, are becoming an increasingly researched topic in ecotoxicology. Most of what is understood about environmental microplastics stem from coastal ecosystems. Freshwater systems are currently understudied even though their close relation to urbanization can lead to a considerable amount of microplastic introduction from various sources. This lack of research in freshwater habitats presents a knowledge gap involving microplastic retention within freshwater organisms. To understand their occurrence, it is important to examine bioaccumulation in aquatic invertebrates that reside in habitats where microplastics have been detected (streams). Crayfish make an ideal study taxon due to their prevalence in regional streams. Additionally, crayfish have been experimentally observed to retain microplastics within tissues originating from their habitat. In our study, we use comparisons between two species that exhibit different feeding behaviors, the native Cambarus appalachiensis and the invasive Faxonius cristavarius. We collected 84 crayfish from Strouble's Creek, surrounded by urbanization, and Tom's Creek, surrounded primarily by agriculture and forests. We found there were significantly higher microplastics in the crayfish from Strouble's Creek ($p<0.01$); however, no differences observed in microplastics between invasive compared to native crayfish ($p>0.05$). Our findings suggest that microplastics are accumulated in both native and invasive crayfish species in areas distant and proximal to urbanization. Additionally, examining the habitat degradation gradient can determine areas of concern for the potential biomagnification of microplastics.

**Mentor(s):** Austin Gray (Biological Sciences), Virginia Tech
Bryan Brown (Biological Sciences), Virginia Tech

**Lindsey Finks**
Virginia Tech/Environmental Data Science

**Exploring Critical Zone Controls on Runoff Generation in 92 watersheds across the Southern Appalachian Mountain Region**

Streamflow regimes vary due to climate and physical metrics such as topography, land cover, soils, and bedrock properties. For example, previous studies suggest watersheds in the Blue Ridge physiographic province in the eastern United States have lower baseflow variability and higher proportion of baseflow than the Piedmont due to regional differences in soil depth and flow-restricting horizons. In this study, we examined several descriptive metrics of streamflow variation, called hydrologic signatures, and critical zone structure across the Appalachian mountains. We calculated baseflow index, baseflow variability, flashiness, and mean flow of 92 reference watersheds over 30 years using data from the USGS GAGESII dataset. We also gathered metrics describing critical zone structure in these watersheds, such as slope, depth to bedrock, elevation, and soil permeability. We then used random forest and multiple linear regression models to predict hydrologic signatures using the critical zone metrics. Initial results suggest streamflow indices are driven by relationships between soil thickness and bedrock depth. Critical zone structure therefore may have greater influence over surface topography in flow generation relationships. These findings can help further our understanding of hydrologic partitioning within physiographic regions and help to better understand critical zone influence on regional runoff generation.

**Mentor(s):** JP Gannon (CNRE Forest Resources and Environmental Conservation), Virginia Tech

**Lindsey Finks**
Virginia Tech/Environmental Data Science

**Mitch Dolby**
Virginia Tech/Geography

**Native Lianas of Virginia's Appalachian/Blue Ridge Forests: Environment and Ecology**

Lianas are woody vines that are rooted in soil and grow on trees. Mostly inhabiting forested areas, lianas play a considerable role in shaping the forest ecosystems. Liana and host tree relationships can help facilitate or hinder forest recovery after low-level forest ecosystem disturbance as they alter forest structure, canopy, diversity, and dynamics. In this study, we gathered baseline field data across 102 plots with varying land use histories in Blue Ridge and Appalachian forests in Virginia. The four categories of land use history include secondary forest from logging, agriculture, townsite, and mining. We then used this information to gauge the potential influence of secondary forest locations and the disturbance their history has on the growth of lianas and their relationships with host trees. Analysis included non-parametric testing methods to determine variance between plot records and land use history. We used R and JMP to facilitate analysis of on-the-ground observations and geographically derived components, aggregating native lianas and non-native lianas by plot and plot disturbance. Results infer that the plot with the largest density was in a former mining plot, while the highest average liana density was in secondary forests from logging. Historically agricultural sites had the highest native liana density, while mining had the greatest non-native liana density. Our takeaway from this study is that physical factors, including disruptions deriving from land use history, are potentially influencing the growth, biodiversity, and relationships of lianas in Appalachian forests.

**Mentor(s):** Lynn Resler (Geography), Virginia Tech

**Satya Fisher**
Virginia Tech/Real Estate

**Housing Instability as a Risk Factor for Increased Adverse Childhood Experiences**

Numerous studies have investigated the link between Adverse Childhood Experiences (ACEs) and developmental delays and behavior problems in children, and poor health outcomes in adults. This study aims to examine the relationship between housing instability and the likelihood of children experiencing ACEs. Given the potential negative consequences of ACEs on children's development and health outcomes, it is crucial to investigate the role of housing instability as a possible risk factor. Previous studies on housing and ACEs have primarily focused on urban areas or used data sets too small to draw meaningful conclusions at a national level. To address this gap in the literature, we use national data from the National Survey of Children's Health (NSCH). The sample covers 2020 - 2021 and includes 93,669 households who are eligible for a child-level questionnaire. This will allow us to thoroughly examine the link between housing instability and higher ACE scores at a national level. Our goal for this research is to inform policymakers about the crucial role of housing as a social determinant of health and advocate for increased funding for affordable housing programs. By increasing access to stable and affordable housing, policymakers can help reduce the prevalence of housing instability as a risk factor for ACEs and promote better health outcomes for children and families.

**Mentor(s):** Jaeyong Yoo (AHRM), Virginia Tech

**Sophie Foster Trask**
Virginia Tech/Wildlife Conservation

**Truman Collins**
Virginia Tech/Wildlife Conservation

**Using by-catch data from remotely-triggered cameras to assess distribution and abundance of a little known small felid, the margay, in Belize, Central America**

Remote camera trapping methods have become a crucial part of studies on density and abundance of elusive species. Such cameras take photographs of all animals that pass in front of the heat and motion sensor. Even with target species clearly identified, many additional non-target species are unintentionally recorded as bycatch or ancillary data. One of those species includes the margay (Leopardus wiedii), a small, largely arboreal (i.e. tree dwelling) felid native to the Neotropics. Margays relative abundance, habitat preferences, and activity remain fairly unknown throughout much of their range. In this study, we compiled remote camera-trapping photos of margays from three years (2018, 2019, and 2021) from a study targeting jaguars (Panthera onca) across two distinctly different habitat types in Belize, Central America, including pine and broadleaf forests. Individual margays have distinct coat patterns, which can be compared in photos among different angles to determine how many individuals occur in an area. We identified many individuals and plotted their locations across the landscape to visualize where margays occurred. We also described challenges to using a grid set up specifically for jaguars to study a by-catch species with a much smaller home range and unknown habitat selection.

**Mentor(s):** Marcella Kelly (Department of Fish and Wildlife Conservation), Virginia Tech
David A. Lugo (Department of Fish and Wildlife Conservation), Virginia Tech

**Zachary Fuge**
Virginia Tech/Mechanical Engineering

**Implementation of Path-Planning onto the Quadruped Robot, SQUEAKY**

In this work, a simple path planner is implemented utilizing Robot Operating System (ROS) onto the quadruped robot, SQUEAKY, to enhance the existing locomotion strategy with a level of robustness in the presence of obstacles. For this specific case, an INNO 2D Lidar and local webcams are utilized to enable perception of the quadruped's surroundings. The path planner navigates to the user input target position by exploiting perception to maneuver in a dynamic environment, while keeping processing power low to ensure quick responses. A Raspberry Pi is employed as the high-level balance and locomotion controller with a Teensy 4.0 acting as the low-level motor controller. The methods utilized in this research include ROS both for simulation and implementation of the path planning algorithm for the ease of use in sensor integration. Simulation and hardware results demonstrate the effectiveness of the optimization-based path-planner and perception algorithm on SQUEAKY. Overall, this work will be useful to sensor-based integration and robotic balance coordination research and is generalizable to any kind of multi-legged robot.

**Mentor(s):** Alexander Leonessa (Mechanical Engineering), Virginia Tech

**Sophia Fulton**
Virginia Tech/Physics

**Mary Conner**
Virginia Tech/Physics

**Graham Lang**
Virginia Tech/Physics

**Savannah Church**
Virginia Tech/Physics

**Justin Gandhi**
Virginia Tech/Physics

**Searching the Galaxy for Neutral Hydrogen Emissions**

In this project, we investigated neutral Hydrogen (HI) radiation and compared virtual and human source finders to detect them. We partnered with Dr. Danielle Lucero to complete this project. Our results will be used in her Computer Modeling and Data Analysis (CMDA) course's capstone project. Our group was given data cubes that contained HI radiation from the galaxies and we used both source finders to find and analyze the HI emissions. By doing this, we were able to answer questions related to how much HI is in galaxies as a function of redshift, if observed HI masses corresponded with expected values, the best methods for searching a data cube for HI emissions, how to characterize a 'real' signal over artifacts or noise spikes, and if humans were better detecting HI in data cubes than automated source finders. We used viewing software (e.g., CARTA, CASA) to detect HI radiation in data cubes and compared to virtual source finders (e.g., SoFiA) that are known to review data cubes faster than humans but are not as accurate. This can affect the consistency and accuracy of results using these HI detections. We anticipate that human evaluations will be more effective in finding false positive and negative detections from virtual source finders. By using citizen scientists to make and approve of the realness of HI detections, radio astronomers will have the much-needed assistance in analyzing the large excess of data that is currently present in the field.

**Mentor(s):** Sarah Munford (Systems Biology, College of Science), Virginia Tech
Danielle Lucero (Physics, College of Science), Virginia Tech

**Stasio Gauza**
Virginia Tech/Mathematics

**Search for Novel Metabolites Through Untargeted Metabolomic Analysis in Methanococcus maripaludis**

Methanococcus maripaludis is a methanogenic archaeon, isolated from marshlands in the Southeastern United States, where it has a major thermodynamic contribution to microbial degradation of complex materials. For this reason we are interested in obtaining a complete picture of its metabolic activities and here untargeted metabolomics, or the study of metabolites, is an effective approach as it provides an unbiased connection between the genomics, proteomics, and physiological responses of an organism. Untargeted metabolomic analysis is the survey of all metabolites within an organism, which we perform with the objective of identifying a novel metabolite for further targeted metabolomic analysis. Towards this objective, with samples generated in our laboratory, a set of LC-MS/MS data for the metabolites were collected by Department of Energy Joint Genome Institute. This required a sample to first be separated with liquid chromatography, then run through a standard MS, followed by fragmentation of each metabolite and another MS analysis. The resulting data set contains the m/z, retention time, and fragmentation pattern of each metabolite. GNPS and MZMine2 software were used to analyze the data by constructing a network of metabolites based on similarity and matching fragmentation patterns against metabolite libraries.

The analysis was able to identify with high confidence the presence of glycerophosphocholine, carboxylic acids, and monoolein, among other lower confidence matches. We will continue the project by verifying the presence of glycerophosphocholine in M. maripaludis and assessing presence across various growth conditions.

**Mentor(s):** Biswarup Mukhopadhyay (Biochemistry), Virginia Tech
Christian Heryakusuma (GBCB), Virginia Tech Graduate School

**Arbaaz Gill**
Virginia Tech/Biological Sciences - Biomedical Option

**Isabella Filippone**
Virginia Tech/Human Nutrition, Foods, and Exercise

**The Role of Endothelial Nitric Oxide Synthase in Exercise-Induced Gene Expression Changes in the Heart**

Vascular homeostasis is important for molecular signaling within the heart during acute bouts of exercise. Endothelial nitric oxide synthase (eNOS) is an important enzyme that maintains vascular homeostasis. eNOS achieves this by producing nitric oxide (NO), a critical vasodilator. This study aims to investigate whether eNOS is necessary for the upregulation of exercise-responsive genes in the heart and whether eNOS is involved in regulating genes involved in cardiac muscle contraction. To investigate the role of eNOS in the heart following acute exercise, we subjected mice lacking eNOS (KO) and age-matched wild-type (WT) controls to a 1-hour acute endurance-type treadmill running protocol. Mice were compared to sedentary controls. To assess eNOS-dependent changes due to exercise, quantitative polymerase chain reactions (qPCR) were performed on cDNA synthesized from total RNA extracts from heart tissue. We observed an increase in exercise-responsive genes that are involved in various biological processes, including the regulation of energy metabolism and mitochondrial function (Nr4a3 and Pgc-1a). However, we observed a decrease in the expression of Myh7 and Mybpc3 genes in response to exercise in mice lacking eNOS, suggesting that eNOS is necessary for the regulation of genes involved in cardiac muscle contraction. Myh7 and Mybpc3 are important genes for the regulation of cardiac muscle contraction, and their decrease in expression may have negative implications for cardiac function. These results suggest that the heart is an organ sensitive to acute exercise, and eNOS might be an indispensable factor for the acute exercise response.

**Mentor(s):** Siobhan Craige (Human Nutrition, Foods, and Exercise), Virginia Tech

**Carson Gilmore**
Blacksburg High School/Advanced Studies

**Effect of Conjugated Linoleic Acid Supplementation on Skeletal Muscle Composition in Mice**

It has previously been shown that supplementation of conjugated linoleic acid increases the amount of force mice put out in an in vivo torque frequency test. The reason for this is unknown, but might be explained through examination of skeletal muscle from the supplemented mice. This research aims to explore the nuclei content and extracellular matrix of quadricep tissue from supplemented mice, with the goal of determining why CLA supplementation leads to increased force. Upon discovering the reason, the body of knowledge surrounding CLA increases, and it further has potential to be supplemented by humans. The desired variables were studied through immunohistochemistry, using an anti-laminin antibody to reveal ECM content, and counterstaining with DAPI to show nuclei. After imaging the treated muscle sections, the following results were determined: Tissue treated with CLA showed a similar average nuclei count in 200x200 micron sections to that of untreated muscle (66 to 65 respectively). Tissue from supplemented mice contained more ECM. The increase in ECM could potentially be the reason for increased force, given that it plays a large role in producing effective/efficient muscle contractions. This means that an increase in ECM could lead to either stronger contractions, and/or more contractions in a given movement. Although this seems to explain the connection between CLA and increased strength, these results were taken from two mice, and can't yet be proven significant. More tests are currently being run to determine whether or not CLA has a significant effect on ECM content.

**Mentor(s):** Deborah Good (Department of Human Nutrition, Food, and Exercise), Virginia Tech
Joon Choi (Department of Human Nutrition, Food, and Exercise), Virginia Tech

**Gina Girgente**
Virginia Tech/Geography

**Urban Growth Simulation for Selected Coastal Cities of the Eastern U.S.**

Coastal ecosystems are under increasing pressure from population and urban growth, sea level rise, and climate change. Reliable models of these changes can help land/water managers and decision-makers plan for and mitigate undesirable outcomes to better meet societal needs. Focusing on the urban growth component, the main objective of this research is to develop a simulation model for coastal urban areas with meaningful interpretation and inference. Land cover products from NOAA C-CAP and NLCDs are used to identify forest-urban and agricultural-urban change locations from 1992-2019. A number of geographical and social variables are assembled to model urban changes using logistic regression model. These explanatory variables include elevation, slope, distance to road, distance to existing urban, and population density. Using the resultant urban change probabilities from logistic regression models, we further evaluate various growth scenarios, such as business as usual, growth as planned, and resilient growth for 2020-2050. The model development initially focuses on Hampton Roads Metropolitan Statistical Area, VA. However, the modeling framework and data requirement is general applicable and transferable to other coastal cities in the eastern US. Results from urban growth simulation models can be combined with future sea level rise scenarios for more in-depth analysis.

**Mentor(s):** Yang Shao (Geography), Virginia Tech

**Gina Girgente**
Virginia Tech/Geography

**Reconstructing the Past Environment around Mountain Lake, Giles County, VA**

Very few natural lakes occur in the Appalachian Mountains, one of the most biologically diverse regions in the temperate world, but Mountain Lake in Giles County, Virginia, is an exception. Sediments accumulating on the lake bed provide an opportunity to study past climate and environment in this high conservation value region. Paleoenvironmental records are needed in particular to inform estimates of the past extent of grassland habitats, as these habitats are especially threatened today. This research uses carbon isotope values measured in sediment cores collected from Mountain Lake to reconstruct past vegetation dynamics in the area around the lake. Plant carbon isotope values are driven primarily by their photosynthetic pathways with C3 plants (most trees and shrubs) having considerably lower values than C4 plants, which are primarily grasses (averaging -27% vs -12%, respectively). Decreases in lake sediment d13C values, therefore, provide evidence for more forest-like vegetation in the surrounding area, whereas increases suggest more grassland. We collected a 370 cm long sediment core from Mountain Lake, which dates to 1746 cal BP at 326 cm depth. We then extracted organic carbon from the sediments (mostly dead plant matter) for isotopic analysis, which was completed in the Stable Isotope Lab in the Department of Geosciences. d13C values measured between -28 and -27%, suggesting that the area has been forested since at least 2,000 years before present.

**Mentor(s):** Rachel Reid (Geoscience), Virginia Tech
Lisa Kennedy (Department of Geography), Virginia Tech

**John Glass**
Virginia Tech/Biological Sciences

**Emily McNulty**
Virginia Tech/Microbiology

**Aidan Ramee**
Virginia Tech/Neuroscience

**Analyzing the effectiveness of alternative fuels as a replacement for petroleum fuels in the Montgomery County area**

The purpose of this proposed study is to examine the effectiveness and sustainability of biofuels as a replacement for petroleum-based fuels. Biofuels are a gasoline substitute that reduce the stresses of carbon emissions. They are typically produced using plant matter, with the species of plant dictating which type of fuel is produced. Ethanol is the most common type of biofuel, produced from fermenting corn, though other biofuels make use of materials like tree waste. Most gasoline sold in the U.S. is required to have a certain percentage of ethanol in the mixture, in order to reduce the amount of emissions that cars produce. Biofuels reduce carbon emissions due to their organic chemistry and lower carbon footprint during synthesis and transportation. The goal of this study would be observing and measuring public opinion of biofuels and their effectiveness in Montgomery County. An anonymous survey would be made, asking simple questions such as ‘what gas do you use,’ listing the available fuels in the area, and asking their personal opinions on alternative fuels. We will limit our scope to responses from Blacksburg residents and Virginia Tech students and staff. The anticipated outcome is that if the results of the study are made public, the students and residents of the area will have raised awareness on the fuels the county uses in public transportation. This heightened awareness may lead to increased demand for research, usage, and public awareness of biofuels in the U.S.

**Mentor(s):** Amanda MacDonald (University Libraries), Virginia Tech

**Courtney Glover**
Virginia Tech/Criminology

**Lightswitch Policing**

Lightswitch Policing is a research project involving comparative analysis of both the contrast between on versus off campus policing as well as the difference between the training that law enforcement officers from both spaces participate in. Analyzing these parallel relationships will help create a better understanding of how to improve both general public policing and college policing so that there is a balance of ethics and morals. The issue of ethics arises when minority races receive a different treatment from law enforcement. This proposal explores that by collecting and dissecting data concerning the proportions of encounters between law enforcement and civilians or students. The collection of the data consists of student and citizen surveys to determine this proportionality or lack thereof. Collecting data on training requirements is a similar process but the surveys are collected from organizations rather than individuals. This proposal does not take a stance, however, there are expected results of on campus policing as a whole being more lenient than its counterpart. As for the ethics, it is expected that minorities, specifically people of color, are more likely to have encounters with law enforcement for more severe offenses and their white counterparts more likely to receive a disproportionate amount of leniency even for minor infractions.

**Mentor(s):** Anne Brown (Research and Informatics), Virginia Tech

**Nicole Gray**
Virginia Tech/Psychology

**Vincent Le**
Virginia Tech/Psychology

**Blair Butler**
Virginia Tech/Psychology

**Elizabeth Chimento**
Virginia Tech/Psychology

**Nikita Pike**
Virginia Tech/Psychology

**Anagha Kesarinath**
Virginia Tech/Psychology

**Team Member Attributes and Team Performance**

The primary objective of this research is to study how personality characteristics and team dynamics impact team performance. Past research has shown the importance of personality (Prewett et al, 2009) on individual-level performance and the importance of team positive affect (feelings and emotions) on team functioning and cooperation (Huang, 2009); however, little is understood about how the distribution of personality characteristics within a team impacts team performance. We investigated how team personality, team positive affect, team cohesion (how well team members work with one another) and team efficacy (belief that the team can succeed) impacted team performance (Kozlowski & Ilgen, 2006). Our work contributes to understanding how to improve team performance. We studied virtual teams of students as they played a collaborative computer video game and assessed how the individual personality characteristics combine to impact team performance. Each team member had unique information that needed to be communicated with the team in order to successfully complete the task. Teams played four levels of the game (5 minutes each), and at the end of each level, completed questionnaires that assessed team dynamics and team performance. Regression results showed that teams higher on team positive affect performed better. Higher levels of team cohesion and team efficacy were also related to higher team performance. Our research helps us better understand how team composition and team functioning are related to team performance, and how some teams work better than others.

**Mentor(s):** Roseanne Foti (Psychology), Virginia Tech
Yasmine Elfeki (Psychology), Virginia Tech
Fabrice Delice (Psychology), Virginia Tech

**Christa Greatorex-Potter**
Virginia Tech/Biochemistry

**Using In-Silico Techniques to Design Novel Antagonists of Propanediol Dehydratase**

The gut microbiomes of humans and animals consist of a wide variety of healthy bacteria. Escherichia Coli (E. coli) are a typical bacteria in the human body, and while most strains are harmless, certain strains may lead to etiopathogenesis. Adherent Invasive E. coli (AIEC) is an example of a pathogenic E. coli strain, as they invade and adhere to the lining of the intestines, causing inflammation. The inflammation caused by AIEC has been linked to the development of Crohn's Disease (CD) by the propanediol metabolic pathway. Propanediol dehydratase is involved in this metabolic pathway that allows AIEC to thrive and inflame the intestinal lining. Because current treatments for CD are highly limited and non-curative, novel antagonists of propanediol dehydratase are needed to effectively prevent AIEC from colonizing the intestinal lining and causing its characteristic inflammation. Molecular docking and computer-aided drug discovery (CADD) was utilized to predict the interactions between the ligand 1,2-propanediol and propanediol dehydratase at the atomistic level and used to propose structural hypotheses on ligand binding modes to improve targeting and inhibition of propanediol dehydratase. Fingerprinting and pharmacophore modeling were used to identify a hydrophobic region in the binding cavity surrounding 1,2-propanediol. Potential key residues found within this region to exploit for inhibitor interactions are H143 and D335. Further literature review revealed a third residue, E170. Currently, virtual screening using an in-house bash script is being performed to scan for known FDA-approved compounds in the ZINC20 database that may bind to propanediol dehydratase. These methods are being completed in order to accomplish the goal of designing antagonists of propanediol dehydratase that could lead to the development of improved treatment options for CD patients.

**Mentor(s):** Anne Brown (Biochemistry), Virginia Tech

**Colin Greear**
Virginia Tech/Biological Sciences

**Examining the Relationship Between Nomadism and Life History Traits in Avians Using Phylogenetic Comparative Methods**

The purpose of this study is to examine the connection between nomadic migratory behavior and life history traits in birds using phylogenetic comparative methods. Can nomadism be described as an expression of low site fidelity? What life history traits are conducive to this behavior? This study seeks to reevaluate avian migration through a lens of viewing the various migratory states as occupying different positions on a "migratory compass," the axes of which are distance traveled and site fidelity. This is for the larger purpose of positing a more concrete definition of avian nomadism. Two datasets and a phylogeny of bird species were merged by species, containing various traits of 8,801 bird species. Phylogenetic least squares analyses were performed to test the relationships between migratory state and the following variables: fecundity, longevity, and juvenile mortality, as well as the relationships between fecundity and longevity and fecundity and juvenile mortality, all conditioned by migratory state. Additionally, the relationships between fecundity, longevity, and juvenile mortality with migratory state mediated by territoriality strength were examined. As the results pertain to nomadism, the study's findings included a non-significant negative relationship between longevity and nomadism, a non-significant weakly positive relationship between juvenile mortality and nomadism, a non-significant weakly positive relationship between fecundity and nomadism, a significant weakly-positive relationship between fecundity and the interaction between nomadism and strong territoriality, and a significant strongly-positive relationship between longevity and the interaction between nomadism and weak territoriality.

**Mentor(s):** Josef Uyeda (Biological Sciences), Virginia Tech
Nicholas Bone (Biological Sciences,) Virginia Tech

**Jessie Green**
Virginia Tech/Wildlife Conservation

**More Concrete, More Cowbirds - Impervious Surface Cover Influences Brood Parasitism Rates of Song Sparrow (Melospiza melodia) Nests in the New River Valley**

The rapid spread of urban and suburban human development strains its inhabitants by limiting available territories and nesting locations. The New River Valley is no exception, and is a prime example of rapid development. During prior work, we noticed urban areas had an increased number of nests that have been parasitized by brown-headed cowbirds (Molothrus ater) compared to rural sites. Brood parasitism, the act of a bird laying eggs in the nest of a different species, has been shown to have negative effects on its host. We hypothesized that paved areas and fewer, more clustered nesting locations would increase rates of brood parasitism within urban sites. Using ArcGIS Pro and 6 years of nest data collected at Virginia Tech and Radford University, we found that impervious surface cover in a song sparrow's territory had a significant positive relationship with the rate of brood parasitism in urban sites. While cowbird nestlings often outcompete their smaller nest-mates, we found no evidence that the presence of a brood parasite affects the success of song sparrow nests. More studies are needed to analyze the many factors influencing songbird nesting success in urban environments. Our findings in this study have wide implications for birds that occupy a similar suburban niche to song sparrows and are similarly imperiled by urbanization effects.

**Mentor(s):** Kendra Sewall (Biological Sciences), Virginia Tech

**Julia Gregory**
Virginia Tech/Microbiology

**Understanding Regulation of Mitochondrial Function by Immune Receptor NLRX1 during Lyme Disease**

Lyme disease, caused by the bacterium Borrelia Burgdorferi, is an emerging tick-borne disease in the United States. If left untreated, 60% of individuals will develop chronic inflammation of the joints known as Lyme arthritis. Currently, we have limited therapeutics for this inflammation, making it essential to determine new treatments for Lyme arthritis. In host-pathogen defense, an anti-inflammatory immune receptor called NLRX1 can defend against pathogen burden through the regulation of cell metabolism, in which NLRX1 binds with the mitochondria to provoke antimicrobial reactive oxygen species (ROS). In previous studies infecting wildtype and Nlrx1-/- mice, we found that NLRX1 decreases Lyme arthritis presentation and severity. Because NLRX1 has a protective role against Lyme arthritis, we hypothesized that this could occur through its regulation of metabolism. Here, we harvested macrophage immune cells from wild-type and knockout mice and infected them with an MOI of 100:1 of Borrelia burgdorferi. We then stained these cells with fluorescent dyes for mitochondrial membrane potential and ROS, captured photos, and analyzed the Mean Gray Value (MGV) of fluorescence through Fiji ImageJ to determine mitochondrial function. We found that NLRX1 decreased normal mitochondrial membrane potential, indicating a shift in mitochondrial polarization. Further, we determined that NLRX1 subsequently promoted elevated ROS generation during infection. Ultimately, this indicates that NLRX1 could be dysregulating normal mitochondrial function to overproduce ROS in a mechanism of host antimicrobial defense mechanism against Borrelia. These studies warrant further investigation into host defense mechanisms utilized by NLRX1.

**Mentor(s):** Irving Allen (Biomedical and Veterinary Sciences), Virginia Tech

**Jonas Guilliano**
Virginia Tech/Biological Sciences

**Exploring the Relationship between Abiotic Factors and Biodiversity in Ephemeral Freshwater Systems of Southeastern Arizona**

Ephemeral systems are areas that may be flooded for short periods throughout the year and dry during others. Ephemeral systems are common worldwide, especially in arid environments, but are largely neglected by ecologists. Biodiversity is an important part of the ecology of a system. The composition of a community, and thus the biodiversity, can be driven by a multitude of abiotic and biotic factors. This study examined the macroinvertebrate biodiversity of several ephemeral freshwater sites in southeastern Arizona to try to understand what abiotic factors may be driving that diversity, such as altitude, dissolved oxygen, and the temperature of the site. Invertebrates were sampled from four sites once a week for four weeks during the summer of 2022. Temperature and dissolved oxygen were also measured when invertebrates were collected. Preliminary results show that the four sampled sites are dominated by Notostraca Triopsidae (Triops), Ephemeroptera Baetidae (Mayfly), Coleoptera Hydrophilidae (Water Beetle), and Anostraca (Fairy shrimp). These results will be analyzed alongside abiotic factors to determine what may be driving the differences in community composition.

**Mentor(s):** Meryl Mims (Department of Biological Sciences), Virginia Tech
Grace O'Malley (Department of Biological Sciences), Virginia Tech

**Miles Guth**
Virginia Tech/Biological Sciences

**Viral Interference in Intercellular Communication: An Exemplification of Scientific Trial and Error**

Viral infections are a well-known biological fact of life. Despite the fact that viruses are not defined as living things, they remain the most biologically and genetically diverse entities on the planet. They can infect any living organism and cause significant damage to the cells. The goal of this project was to determine how a virus will impact the ability of adjacent cells to communicate with each other with a focus on gap junctions and connexin 43. Using a previously published protocol to assemble a modular adenovirus genome in vitro, HEK293 cells were transfected with the assembled genome in hopes of proliferating the virions. Electroporation was used to subvert the barrier provided by the plasma membrane and allow for better viral uptake in the cell culture. Cultures were examined for evidence of CPE caused by viral amplification, but counter to the hypothesis, none was found. Viral amplification was unsuccessful and multiple trials were undertaken to ensure the modular genome was not the source of error. Upon attempting the same protocol with multiple genome structures, none produced sufficient viral amplification. Immunofluourecse microscopy was intended to inspect the effect of the virus on the function of gap junctions and Cx43, but given our results, this was not feasible. The project became a lesson for the hardships of biological research and evidence of a need for deeper examination of viral genomes as well as viral interference of intercellular communication.

**Mentor(s):** Jamie Smyth (Department of Biological Sciences (Fralin Biomedical Research Institute at VTC)), Virginia Tech

**Dana Hamad**
Virginia Tech/Biochemistry

**Biochemical Pathways of Food Allergies**

Food Allergies are an overreaction which occurs when the immune system identifies a normal food product as a harmful pathogen and produces high levels of an antibody, called immunoglobulin E (IgE). The immune system protects our body against harmful pathogens that can cause an infection. Previous research discusses the genes involved in the immune system response associated with food allergies and the different mechanisms involved. Additionally, previous artists have created illustrations of the communication between certain genes and the immunological mechanisms contributing to allergic sensitization. The issue lies in the absence of a big picture and a greater comprehension of how all these genes and mechanisms work together. This study aims to create greater comprehension through the creation of a novel artistic visual representation of all the major biochemical communications which occur at large in the immune system/biological food quality control system during a food allergy induced reaction. A key of major individual components will be included as well. To do so, each individual component was researched, its position and relationship explored, and its information was compiled in a mass document. Then existing images of genes and mechanisms were compiled into another mass document. Using both as templates, a visualization guide was created using several scientific media databases. This visualization aims to serve as a guide for larger research into food allergies, which is now endemic in many developed countries and industrialized parts of the world. With growing costs due to hospitalization, impairment of daily life, and possible fatality due to consumption or exposure, a solution is needed more than ever before.

**Mentor(s):** Clement Vinauger (Department of Biochemistry), Virginia Tech

**Dominic Hanna**
Virginia Tech/Automotive Engineering

**Christopher Barrett**
Virginia Tech/Space Systems

**Catalina Reinhart-Diaz**
Virginia Tech/Industrial and Systems Engineering

**Vasu Gatne**
Virginia Tech/Computer Science

**Perceptions of Non-Verbal Communication in Automotive Contexts**

Perceptions of Non-Verbal Communication in Automotive Contexts is researching the development of an alternative car horn system that increases the abilities of drivers to communicate with each other in a non-verbal manner. Car horns are currently loud, abrasive, and do not carry a significant amount of information. Through research on perceptions of non-verbal communication in the context of automotive scenarios we hope to develop a new horn that will allow for more specific communication between drivers. Current research is focused on developing a sound palette through user feedback and determining whether or not humans can accurately discern situationally relevant information through non verbal communication. Current results are indicating that users of a prototype horn feel that the current sound palette is sufficient to relay messages they would want to communicate in a variety of scenarios.

**Mentor(s):** David Gray (ENGE), Virginia Tech

**Marali Harikar**
Virginia Tech/Biological Sciences

**Melissa Kramer**
Virginia Tech/Animal and Poultry Sciences

**Shloka Adapa**
Virginia Tech/Psychology

**Rebecca Fregoso**
Virginia Tech/Psychology

**Elsa Fry**
Virginia Tech/Psychology
**Sarah Green**
Virginia Tech/Psychology

**Is a Basis in Semantic Knowledge Required for Unitization of Item and Context Features in Episodic Memory?**

A specialized encoding strategy termed “unitization” has been shown to reduce the reliance on hippocampal processing for long-term episodic memory associations between a to-be-remembered item and its context. Prior studies have assumed that integration of context and event information must have a semantic rather than an arbitrary basis. We manipulated the degree to which a meaningful basis for unitization or a relational association was provided (e.g., to support unitization of the word “alcohol” with the context feature “green”) with both associations based on semantic knowledge (e.g., “The ALCOHOL is green because it is a mint flavored martini,” because mint-flavored items are typically green) and arbitrary associations (e.g. “The ALCOHOL is green when it is poured out of the martini shaker.”) If a unitized representation requires a semantically meaningful association, we should see increased familiarity-based responding for the meaningful unitized items compared to the non-meaningful unitized items, but we did not find any influence of meaningful associations on the contribution of familiarity to retrieval of either unitized or relational associations. However, our initial datasets produced highly variable performance from the participants, with approximately half of participants not meeting criteria for inclusion. We propose some new experimental procedures to improve performance and to provide objective assessments of participant attention to the provided descriptions.

**Mentor(s):** Rachel Diana (Psychology), Virginia Tech

**Payton Harman**
Virginia Tech/Biology

**Bat guano isotope evidence for past vegetation and climate change in southwest Virginia**

The Appalachian Mountains, one of the most biologically diverse regions in the temperate world, have been heavily altered by human activity for millennia yet the relative roles of human and other disturbances in creating modern landscapes are not well understood. Recent research suggests that bat guano deposits can serve as valuable archives of past environmental change. Carbon isotope (δ13C) values of guano from insectivorous bats can reflect the relative abundance of forest (C3) versus grassland (C4) vegetation at a regional scale,. Guano nitrogen isotope (δ15N) values have been linked to landscape-scale N-cycling and precipitation. To investigate the paleoenvironmental history of an Appalachian site in southwest Virginia, we collected a 170 cm guano core from a limestone cave on Salt Pond Mountain. Radiocarbon dates indicate that the bat guano core ranges in age from ~1250 cal BP at the surface to 4600 cal BP at depth. Results show a trend of increasing δ15N values from the base of the core toward the surface (from ~11.5 -to 13.5 ‰). The increase in δ15N values may signal a moistening climate toward the present, a finding consistent with regional Holocene pollen records. In contrast, guano core δ13C values decrease toward the present (from ~ -24.5 % --27 %). Higher δ13C values deep in the core likely indicate a greater prevalence of C4 grassland vegetation on the landscape, which could be linked to drier climate, indigenous burning, or both.

**Mentor(s):** Rachel Reid (Geoscience), Virginia Tech

**Kylie Harris**
Virginia Tech/Wildlife Conservation

**Free-ranging female American black bears (Ursus americanus) display differing ecological behaviors and diet composition depending on the presence of cubs**

American black bears (Ursus americanus) are challenging to study in the wild due to their elusive nature. Female black bears with cubs can be more challenging as they are protective of their offspring, may seek out more isolated areas, and may display different behaviors than other bears to better provide for their young. In 2018-2019, the Virginia Appalachian Carnivore Study placed collars on 15 black bears that were equipped with GoPro-style cameras. Each collar captured 9-20-second videos every 20-60 minutes for 10-14 hours during daytime for 1-6 months, resulting in up to 18 hours of video data per bear. For this project, we specifically examined one female with a single cub from early-June to mid-December to categorize and assess behavior types, timing, and duration for comparison to another female black bear from the same survey year. Our preliminary results have shown the mother bear was not necessarily in isolated areas and instead was more commonly close to human settlements. She also exhibited different behaviors such as climbing trees to avoid other bears and fed on different diet items (e.g., less invasive species and less meat consumption) than the other female. Our results provide a better understanding of differences in behaviors and diet composition of female bears with and without cub(s), which can aid in better forming wildlife management plans.

**Mentor(s):** Marcella Kelly (Fish and Wildlife Conservation), Virginia Tech
Brogan Holcombe (Department of Fish and Wildlife Conservation), Virginia Tech

**Gregory Harrison**
Virginia Tech/Computational Modeling and Data Analytics

**Using Gradient-Boosted Machine Learning Models to Forecast Lake Water Quality**

Forecasting in ecology has potential to improve natural resource management and advance predictive theory. To help realize this potential, the Ecological Forecasting Initiative is hosting a data science challenge to accurately forecast observations at National Ecological Observatory Network (NEON) sites across the U.S. We focused on the challenge's aquatics theme, by generating 1- to 30-day ahead forecasts of water temperature, dissolved oxygen, and chlorophyll-a at 24 lakes and streams. The goal of this project is to produce and evaluate forecasts of these variables using the extreme gradient-boosted machine learning model (XGBoost) that is trained on historical observations and weather data. First, we deployed the trained model on February 14, 2023, to automatically generate probabilistic forecasts every day using cloud compute (GitHub actions) that rely on NOAA weather forecasts as inputs. This automated approach allowed for consistent and repeatable generation of forecasts as new NOAA weather forecasts and NEON data became available. Second, we evaluated the performance of this model by comparing it to baseline ("null") forecasts of persistence and climatology. Due to seasonal weather conditions (e.g., many lakes still being frozen), our initial results focus on Barco and Suggs Lakes in northern Florida. We found that our model is more accurate than both baseline models for forecasts of oxygen and temperature but performs worse than the climatology model for chlorophyll-a. This project directly contributes to a growing set of automated forecasting models that will be used to quantify the boundaries prediction in ecology.

**Mentor(s):** Quinn Thomas (Forest Resources and Environmental Conservation), Virginia Tech

**Eleanor Harrison**
Virginia Tech/Dairy Science

**Molecular and gene expression changes in liver tissue from mid-lactation dairy cows supplemented with methionine during a subclinical mastitis challenge.**

The objectives were to assess molecular changes in the liver of cows supplemented with methionine during solely a subclinical mastitis challenge (SMC). Thirty-two multiparous Holstein cows (145±51 DIM) were enrolled in a randomized complete block design and assigned to either a basal diet (CON; n=16) or a basal diet supplemented with rumen-protected methionine (SM; n=16, Smartamine M 0.09% DM). The dietary treatment was administered at -21 days relative to a SMC, and data were collected from 0 to 3 days. At 0 d relative to SMC, the mammary gland's rear right quarter was infused with 500,000 cfu of Streptococcus uberis (O140J). Liver biopsies were taken -10 and 1 d relative to SMC. Genes related to methionine and glutathione metabolism, inflammatory response, and oxidative stress were analyzed via qPCR. Data were analyzed using the PROC MIXED procedure of SAS. Significance was declared at $P \leq 0.05$ and trends at $P \leq 0.10$. A trend ($P = 0.07$) for greater milk yield (+0.9 kg) was observed in SM cows than CON. Immune cell signaling gene MYD88 was downregulated ($P = 0.01$) in SM cows compared with CON. A trend ($P = 0.06$) in haptoglobin (HP), a positive acute-phase response, was observed, where HP was downregulated in SM cows compared with CON. A transcription factor involved in antioxidant regulation, NRF2, was upregulated ($P = 0.01$) in SM compared with CON. A trend ($P = 0.09$) was observed in glutathione synthetase (GSS), which directs the final step in glutathione biosynthesis, where GSS was upregulated in SM cows compared with CON. The lower reduction in milk yield in SM cows during the SMC could be associated with upregulation of antioxidant-related genes and downregulation of inflammatory-related genes.

**Mentor(s):** Johan Osorio (Dairy Science), Virginia Tech

**Miriam Hilt**
Virginia Tech/Wildlife Conservation

**EXAMINING PHENOTYPIC PLASTICITY IN THERMAL ACCLIMATION OF METABOLIC RATE IN PLETHODON CINEREUS**

Plethodontid salamanders play a vital role in Central Appalachian ecosystems, contributing the majority of vertebrate biomass and regulating invertebrate communities. As ectotherms, their body temperature relies on external temperature regulation. This causes temperature to impact a variety of physiological, life-history, and behavior traits, from seasonal habitat selection to foraging behavior. The onset of climate change poses an important question to the future of these organisms. Metabolic rate (MR) is linked to growth and reproduction, and has consistently shown to be impacted by temperature; higher temperatures are associated with higher MR, despite the overall low MR of amphibians. We investigated the impact of long-term temperature acclimation on Plethodon cinereus to determine if this impacts MR. Our specimens were exposed to two temperature manipulations, long- and short-term, in warm and cool groups. Individuals were placed in a Field Metabolic System to record baseline MR at their housing temperatures and then were tested at a high- and low-temperature treatment to determine MR variation based on long-term habitat temperature. Using the CO2 data as a byproduct of MR, we analyzed differences between long- and short-term temperature manipulation. Individuals showed no significant differences in MR between groups, indicating long-term climate shift will not impact MR and energy needs. Based on this information, we determined that P. cinereus faces no immediate threat to energy budget due to climate change.

**Mentor(s):** Holly Kindsvater (Fish and Wildlife Conservation), Virginia Tech

**Claudia Hilton**
Virginia Tech/Psychology

**Evan Alvarez**
Virginia Tech/Psychology

**Madicyn London**
Virginia Tech/Psychology

**Brianna Brown**
Virginia Tech/Psychology

**Behavioral Observations of Interpersonal Gratitude on Campus Buses: Modeling vs. Diffusion of Responsibility**

This field research is comparing the differential influence of two notable psychological theories -- observational learning and diffusion of responsibility. Observational learning predicts people will take cues from the actions of others and model relevant behavior. On the other hand, diffusion of responsibility predicts that people will be less likely to take responsibility for the welfare or wellbeing of another person if others are available to actively care. This field study observed expressions of interpersonal gratitude on campus buses, as a function of other passengers expressing similar gratitude. Specifically, undergraduate researchers have been recording whether passengers thank bus drivers as they disembark, and whether a “Thank you” is influenced by the drivers exhibiting prosocial behavior (e.g., saying “Have a nice day!”). Analysis is ongoing and focused on whether passengers exhibit observational learning or diffusion of responsibility more often. Our observations have indicated that prosocial behavior exhibited by the driver increased expressions of gratitude from exiting passengers. While passengers followed a driver,Äôs kind remarks with a “Thank You”, those passengers exiting after this first passenger were less likely to express gratitude, supporting diffusion of responsibility over modeling or observational learning. In our analysis, we also observed group size to record this effect on displays of interpersonal gratitude. Observations are ongoing and additional findings will be reported.

**Mentor(s):** E. Scott Geller (Psychology), Virginia Tech
Jack Wardale (Psychology), Virginia Tech

**Kristal Hines-Pressley**
Virginia Tech/Biochemistry

**Molecular docking of a novel small molecule into HIV Gp41**

HIV drug development focuses on several targets, the most popular being reverse transcriptase but one target that slips through the cracks is gp41. HIV is classified as a retrovirus and its most significant impact on the body is the destruction of CD4 T-cells in the immune system. HIV utilizes viral fusion which allows the insertion of a virus into the host cell and is usually attached to the membrane of enveloped viruses in this case HIV which is used to destroy CD4 T-cells. This work is important because there is a gap in novel small molecules that can bind to gp41 and inhibit viral fusion. Molecular docking and virtual screening of various small molecules were performed to understand the potential sites on gp41 that could change the morphology of gp41 and inhibit viral fusion. The data gathered provides the starting foundation to screen more inhibitors and determine modes of action against inhibiting gp41 viral fusion. Multiple molecular docking programs were assessed to determine which algorithm was the most accurate at replicating known crystal structure information on ligands bound to gp41. Glide was deemed the best to execute the docking and Python was used to calculate RMSD values. The structure of gp41's ligand is symmetrical, highly prone to folding into itself, and can produce high RMSD with accurate-looking visualization due to the flipping of the ligand. As a result of using Glide, RMSD values were in the 3-4 Angstroms range along with no inward folding of the ligand.

**Mentor(s):** Anne Brown (Biochemistry), Virginia Tech
Amanda Sharp (Biochemistry), Virginia Tech
Erin Drolet (Biochemistry), Virginia Tech

**Micah Hoernig**
Virginia Tech/Biochemistry

**Analysis of Iron-Sulfur Cluster Association with a Non-Canonical Thioredoxin in Methanocaldococcus jannaschii**

Methanocaldococcus jannaschii is a hyperthermophilic methanogen isolated from hydrothermal vents in the East Pacific Rise. It is a strict anaerobe, and thus molecular oxygen present in its vent environment puts stress on the organism. To combat this stress, it utilizes a thioredoxin system. M. jannaschii is known to have two thioredoxin homologues, Trx1 and Trx2. Trx1 reduces protein cysteine disulfide bonds that form during oxidative stress. Trx2 departs from the canonical thioredoxin role. It is hypothesized to synthesize iron sulfur clusters, and thereby play a redox sensing role. The aim of this project is to determine iron-sulfur cluster association with Trx2 and to characterize the cluster. This is being done through aerobically expressing Trx2 in E. coli, purifying it using Nickel-NTA column chromatography without iron-sulfur clusters, performing in vitro assembly of iron-sulfur clusters, and characterizing the assembled cofactor.

**Mentor(s):** Biswarup Mukhopadhyay (Biochemistry), Virginia Tech
Christian Heryakusuma (Biochemistry), Virginia Tech

**Loralee Hoffer**
Virginia Tech/Psychology

**Muskaan Gupta**
Virginia Tech/Cognitive and Behavioral Neuroscience

**Katie Duffet**
Virginia Tech/Clinical Neuroscience

**Naomi Harvey**
Virginia Tech/Psychology

**Nadinka Taylor**
Virginia Tech/Psychology

**Diffusion of Responsibility as a Determinant of Interpersonal Gratitude: A probability analysis of the interpersonal gratitude expressions of pedestrians**

This behavioral science study compared the influence of social modeling and diffusion of responsibility on interpersonal expressions of gratitude, operationalized as pedestrians waving a sign of thanks to drivers who stop for them at designated crosswalks. Social modeling predicts that after observing a behavior we are more likely to do that behavior ourselves, but diffusion of responsibility predicts that after observing the behavior, people will be less likely to do it themselves because that first person took responsibility for the entire group. Trained observers recorded the behavior of 36,882 pedestrians over 12 consecutive weeks, and recorded how many pedestrians waved a sign of gratitude, and the order in which each pedestrian crossed the road.
The results indicated that the first person in a group waved the most (21.8%), compared to the second (7.13%), third (4.81%), and more pedestrians. The probability analysis reached the same conclusion, showing that the probability of not waving a sign of gratitude, even after observing another person do it, is 84.3% (at n=2). This number only increases as the group size grows (87.4% at n=3). This increase in the probability of not expressing gratitude as the group size increases indicates that diffusion of responsibility had a greater effect than social modeling, presumably because these people felt less obligated to express gratitude because someone else had already. These results imply a need for interventions to boost personal awareness of the impact that expressing interpersonal gratitude can have on wellbeing.

**Mentor(s):** Scott Geller (Psychology), Virginia Tech

**Loralee Hoffer**
Virginia Tech/Psychology

**Anastasia Semenova**
Virginia Tech/Psychology

**Ella Vozzo**
Virginia Tech/Psychology

**Jada Theodore**
Virginia Tech/Psychology

**Nawal Gaal**
Virginia Tech/Psychology

**Thank You Again, Professor: A quantitative analysis of the impact of interpersonal gratitude on subjective wellbeing using thank you cards**

This study builds on the findings of the original "Thank You Professor" study, which assessed the impact of interpersonal gratitude on mood states using students who gave their professor a thank you card (TYC). A qualitative analysis of the comments on the original TYC's evidenced uniformly positive emotions from not only the professors, but also from all 64 participants after having delivered the TYC. A quantitative analysis of the survey data concluded that the students' overall positive mood states increased significantly by an average of 36% after delivering a TYC to a professor, demonstrating the beneficial impact of expressing interpersonal gratitude.
After such promising results, this second iteration attempts to improve the initial study by better quantifying the professors' reactions to the TYC's using behavioral coding, and by recording the exact message the student wrote for the professor on the TYC (to be used for text analysis). This study also attempts to protect against experimenter bias by having another participant as a "control group," where they fill out the mood survey before and after class but do not give a TYC to the professor. This key factor controls for the idea that students have a more positive mood after class simply because the lecture has ended and they get to leave. 78 students participated in this second study, and ongoing quantitative and qualitative analysis will reveal if the initial findings remain true and students' mood does increase after an act of interpersonal gratitude.

**Mentor(s):** Scott Geller (Psychology), Virginia Tech

**Katelyn Hucker**
Virginia Tech/Statistics

**Brian Walheim**
Virginia Tech/Computer Science

**Ronin Gick**
Virginia Tech/Computer Science

**Milo Craun**
Virginia Tech/Computer Science

**Minahil Malik**
Virginia Tech/Statistics

**Natural Language Processing**

Natural Language Processing (NLP) is a growing topic of research in the machine learning field. NLP allows computers to understand human language using statistical analysis. The goal of this project is to create a system using NLP models to evaluate survey responses. This would give professors valuable feedback from free responses end of semester survey questions by identifying common themes in student responses. We are combining a variety of pretrained models and established machine learning principles to group similar free response questions together. A current goal is to verify the output of the system and quantify the accuracy of the models and clustering. We then want to take this analysis and present them in a way to make it easily readable to any professor who wants to use this tool, in an interactive dashboard. We hope this will make student feedback more accessible and frequent for professors.

**Mentor(s):** David Gray (ENGE), Virginia Tech
Andrew Katz (ENGE), Virginia Tech

**John Hunter**
Virginia Tech/Psychology

**How The Interaction Between Negative Maternal Characteristics and Temperament Predicts The Development of Inhibitory Control in Toddlers**

Inhibitory Control (IC) is critical to the development of children's executive functioning (Munakata et al., 2011). Social factors, like Maternal Intrusiveness (MI), and temperament, like surgency (SUR), effortful control (EC), and negative affect (NA), affect IC development (Swingler et al.,2018; Usai et al., 2020). The goal of this study was to explore how MI and temperament interact to predict IC. Mothers and their toddlers (n = 410) participated. MI was coded during an interaction task at 24 months. Mothers reported on temperament at 36 months using the Child Behavior Questionnaire (Rothbart et. al., 2001). IC was measured at 48 months using the tongue task, in which participants hold a snack on their tongue for increasing amounts of time. Regression was used. Step 1 included temperament, step 2 included MI, and step 3 included interaction terms between each temperament trait and MI. Step 3 was significant [$F(3,402) = 4.367$, $R2 = .043$, $p < .05$]. The interaction term between MI and SUR was significant ($ß = .089$, $p < .05$). This interaction was probed using Process. SUR moderated the association between MI and IC, such that children who experienced high MI had better IC, but only when they were high in SUR ($ß = .06$, $p < .05$). Because factors like MI are typically understood to negatively impact the development of processes like IC, these results suggest that the role that social and temperamental factors play in the development of IC is not sufficiently understood.

**Mentor(s):** Martha Ann Bell (Psychology), Virginia Tech
Jennifer J. Phillips (Graduate Student Mentor – Psychology), Virginia Tech

**Amiya Jenkins**
Virginia Tech/Medicinal Chemistry

**Dereplication of Bacterial Metabolites Associated with Moon Snail Eggs by NMR metabolomics**

Moon snails are marine organisms that deposit their egg masses without subsequent parental care. The egg masses are rich in nutrients and interestingly they are not attacked by any other organism suggesting they must have a protection mechanism to defend themselves chemically. Symbiotic bacteria could be responsible for producing bioactive metabolites able to protect the egg masses against pathogens and predators. The lack of studies on egg masses led us to investigate the chemical potential of their microbiota. Moon snails' samples were collected in Puerto Rico. 53 bacterial strains were isolated and cultivated in three different media to elicit the production of different metabolites. Extracts were obtained, fractionated, and tested against a few pathogens to prioritize bioactive compounds for isolation. Through NMR metabolomics four strains were prioritized for large-scale cultivation. Their extracts presented interesting proton spin systems when analyzed by MADByTE. Currently, large-scale cultures are being extracted, fractionated, and then the novel-likely compounds will be isolated using HPLC.

**Mentor(s):** Emily Mevers (Chemistry), Virginia Tech
Carla Menegatti (Department of Chemistry), Virginia Tech

**Alonda Johnson**
Virginia Tech/Packaging Systems and Design

**Exploration of Sustainable Insulation Material and Package Design**

Currently, most cold chain distribution systems use insulated shipping containers built with materials that are difficult to reuse or recycle. A large reason for this is that items that go through the cold chain must maintain a very strict temperature range for an extended period of time. This is commonly achieved utilizing non-recyclable materials because of the insulation performance requirements for the package. This causes the distribution of temperature sensitive products such as food and pharmaceuticals to generate a significant environmental impact. This study aimed to identify sustainable materials that can also meet the performance requirements. In this study different material combinations were evaluated including corrugated fiberboard, honeycomb, Expanded Polystyrene (EPS), Starch Based Foam (SBF), Foam Box Panels (FBP), Cotton Box Panels (CBP), PET Box Panels (PBP), Metalized Bubble Wrap (MBW), and Metalized Bubble Roll (MBP). Each material was characterized for thermal resistance and thermal conductivity, using a Heat-Flow Meter. Subsequently, thermal simulations were conducted to evaluate and correlate the performance of the insulated shipping containers with the material properties using the ISTA 7E standard.

**Mentor(s):** Eduardo Molina (College of Natural Resources and Environment, Department of Sustainable Biomaterials), Virginia Tech

**Erica Jones**
Virginia Tech/Biological Sciences

**Investigating the Effect of Heat Treatment on Peanut Pollen Fatty Acid Saturation Levels**

Arachis hypogaea (peanut) is an important oilseed crop for its high levels of protein, fiber, and healthy fats. This study aims to characterize the shifts in fatty acid carbon bonds to gain a sense of saturated and unsaturated levels within the pollen grains. Cellular membranes containing fatty acids with higher levels of unsaturation are more unstable at high temperatures, which could have an impact on pollen development and result in underdeveloped, inviable pollen. We evaluated the impact of temperature on membrane fatty acid composition in developing pollen grains. In this study, five peanut genotypes were grown at 30C until reproductive maturity, and then randomized to treatment conditions (40C) or control temperature (30C). Peanut flowers were collected daily over a period of twenty-four days and their pollen, per ten flowers, was concentrated by filtering and centrifugation. Samples were derivatized using methanolic HCl and separated using a gas chromatograph equipped with a flame ionization detector (GC-FID). Chromatograph data was compiled and analyzed in the R statistical computing environment to identify changes in fatty acid profiles between treatment and control groups.

**Mentor(s):** David Haak (School of Plant and Environmental Sciences), Virginia Tech
Keely Beard (School of Plant and Environmental Sciences), Virginia Tech
David Haak (School of Plant and Environmental Sciences), Virginia Tech
Eva Colla ‘kova' (School of Plant and Environmental Sciences), Virginia Tech

**Daniel Jung**
Virginia Tech/Biochemistry

**Jacob Waybright**
Virginia Tech/Biochemistry

**Jackie Hernandez**
Virginia Tech/Biochemistry

**Sasha Navis**
Virginia Tech/Biochemistry

**Ligand bindings and its relation to Alzheimer's disease**

Acetylcholinesterase is a protein essential for the nervous system in humans. It is a protein enzyme that breaks down acetylcholine, which stops the signal transmission between nerve cells. By doing this, the enzyme can control nerve impulses in the body.

The tertiary structure in the protein creates the active site, which will bind to substrates such as acetylcholine and water. Using Webina and PyMOL allows for redocking of the ligand in this protein, which is important for creating different placements of the ligands, and allows us to see and determine which position makes the protein most effective in doing its job. If an alternative ligand such as tacrine were bound to the acetylcholinesterase receptor rather than the original ligand Huperzine A, then there would be better binding which is indicated by a lower affinity number.

The results were found that the tacrine ligand did have a lower affinity number, which suggests it had better binding to the protein thus making the protein acetylcholinesterase more effective in doing its job. This is important in that making the protein acetylcholinesterase more effective will ensure proper control of nerve impulses, preventing negative side effects such as memory loss, confusion, and muscle weakness.

**Mentor(s):** Anne Brown (Biochemistry), Virginia Tech

**Poojaa Kalathur**
Virginia Tech/Clinical Neuroscience

**Exploring the Roles of Maternal and Parental Characteristics in the Development of Child Behavior Problems**

Frontal EEG asymmetry is associated with individual differences in positive/negative emotionality and approach/avoidance tendencies. Previous studies have shown links between maternal frontal EEG asymmetry and child behavior problems (Chen, Bell, & Deater-Deckard, 2015). Napping and daycare attendance have also been individually examined in the past in relation to child behavior. Napping was associated with increased self-control and academic performance, and decreased externalizing (Lui et al., 2019). More experience with childcare settings has been associated with increased behavior problems through sixth grade (Belsky et al., 2007). This study examined relations between maternal frontal asymmetry, parental attitudes toward their relationships with their child, and age 3 child attention, aggression, and emotional reactivity problems.
We report significant models predicting Aggressive Behaviors (Rsq. = .26, $F(5,35) = 3.805$, $p = .007$) and Attention Problems (Rsq. = .366, $F(5,35) = 5.609$, $p<.001$) only. In both significant models, parent negative attitude towards child relationship was the only significant predictor (Aggression: Beta = .458 , $p = .015$; Attention: Beta= .744 , $p<.001$). Bidirectionality could explain the sole significant parameter: child behavior problems elicit higher maternal negativity, which may provoke child behavior problems (Belsky, 1984). Maternal negative attitudes toward their relationship can induce maternal inattentiveness consequently increasing the risk of attention problems (Setyanisa et al., 2022). Additionally, negative attitudes can severely reduce child's self-esteem resulting in compensatory aggression (Soenens et al., 2008). It is possible that emotional reactivity was not explained by any of the predictors due to the general nature of the questionnaire measurement.
Future directions would examine longitudinal changes in child predictors, like frontal asymmetry, socialization, and social anxiety, and the relations with parental attitudes to predict behavioral problems.

**Mentor(s):** Martha Ann Bell (Psychology), Virginia Tech
Doug Harrison (Psychology), Virginia Tech

**Meghana Kamineni**
Virginia Tech/Medicinal Chemistry

**Peptide-Membrane Simulations and Identification of Key Amino Acids in Brome Mosaic Virus Replication Protein 1a in Protein Targeting**

Brome mosaic virus (BMV) is a plant virus in the Alphavirus-like superfamily which infects cereal plants such as barley, wheat, and rice. BMV, a positive-strand RNA virus, encodes replication protein 1a which localizes to the perinuclear endoplasmic reticulum (nER) membrane, where it induces the formation of viral replication complexes (VRCs). An amphipathic helix termed helix B is responsible for targeting 1a to the nER membrane. The goal of my project is to identify the key amino acids critical in helix B targeting the fluorescent protein GFP to the nER membrane. Site-directed mutagenesis through overlapping polymerase chain reactions was used to generate five helix B mutants with single amino acid mutations. A mCherry-tagged ER marker was utilized to improve the accuracy and quantify ER localization. To further understand the contribution of each amino acid, potential structures of wt and helix B mutants: W416A, G418A, W419A, C420A, and H422A were derived using a structural prediction program that utilizes a deep neural network. MD simulations for the wt and mutant structures were run to understand the interactions that occur in a cellular environment. In addition, peptide-membrane simulations were conducted to understand the interaction between wildtype protein 1a and an ER-like membrane. These results will provide structural and functional correlations of helix B in targeting proteins to the ER membrane and can be applied to the development of antiviral treatments for similar viruses in the alphavirus-like superfamily, such as Hepatitis E and Rubella virus.

**Mentor(s):** Anne Brown (Department of Biochemistry), Virginia Tech
Dr. Xiaofeng Wang (School of Plant and Environmental Sciences), Virginia Tech

**Meghana Kamineni**
Virginia Tech/Medicinal Chemistry

**Peptide-Membrane Simulations and Identification of Key Residues in Brome Mosaic Virus Replication Protein 1a ER Targeting**

Brome mosaic virus (BMV) is a plant virus in the Alphavirus-like superfamily which infects cereal plants such as barley, wheat, and rice. BMV, a positive-strand RNA virus, encodes replication protein 1a which localizes to the perinuclear endoplasmic reticulum (nER) membrane, where it induces the formation of viral replication complexes (VRCs). An amphipathic helix termed helix B is responsible for targeting 1a to the nER membrane. The goal of my project is to identify the key amino acids critical in helix B targeting the fluorescent protein GFP to the nER membrane. Site-directed mutagenesis through overlapping polymerase chain reactions was used to generate five helix B mutants with single amino acid mutations. A mCherry-tagged ER marker was utilized to improve the accuracy and quantify ER localization. To further understand the contribution of each amino acid, potential structures of wt and helix B mutants: W416A, G418A, C420A, H422A, W429A, and G431A were derived using a structural prediction program that utilizes a deep neural network. MD simulations for the wt and mutant structures were run to understand the interactions that occur in a cellular environment. In addition, peptide-membrane simulations were conducted to understand the interaction between wildtype protein 1a and an ER-like membrane. These results will provide structural and functional correlations of helix B in targeting proteins to the ER membrane and can be applied to the development of antiviral treatments for similar viruses in the alphavirus-like superfamily, such as Hepatitis E and Rubella virus.

**Mentor(s):** Anne Brown (Department of Biochemistry), Virginia Tech
Xiaofeng Wang (School of Plant and Environmental Sciences), Virginia Tech

**Cade Karminski**
Virginia Tech/Biological Sciences

**Juvenile Development and Microplastic Resilience in the Conhaway Crayfish**

As increased pressure from anthropogenic pollutants continues to build, a greater understanding of crayfish's life histories is imperative to the preservation of healthy populations. Being a keystone species and ecosystem engineer, the health of native crayfish populations acts as an important indicator of the overall wellbeing and stability of freshwater streams. With Cambarus appalachiensis being described as recently as
2017, little research has been done in terms of their juvenile development and behavior. Our research sheds light on this issue by examining their growth and behavior over the first five months of life. Using photo documentation, the growth of these juveniles were measured, with important benchmarks in these animals' development such as molting frequency, pigmentation, remodeling sediments, and aggressive behavior being observed to occur synchronously across 5 broods of young. In order to execute this experiment, 5 broods of C. appalachiensis were kept with their mother until their third instar, and were then placed in an observation tank. Brood size ranged from 15 to 130 individuals, and survival rates ranged from 16% to 62% over the course of 5 months. After this experiment, they were individually and acutely exposed to medium and high levels of plastic microfibers for a period of 72 hours to document their survival and change in growth rate over the next 3 weeks. With our new understanding of these crayfish's life histories, it is crucial to understand how anthropogenic pollutants like microplastics can affect these juvenile crayfish.

**Mentor(s):** Bryan Brown (Biological Sciences), Virginia Tech

**Morgan Karns**
Virginia Tech/Wildlife Conservation

**Identifying and Facilitating Positive Experiences for Birders with Disabilities**

People with disabilities make up about 25% of the US adult population (CDC, 2018) and 15% of the total global population, yet this community is one of the most understudied groups in recreation research and planning. People with disabilities face more barriers than nondisabled people to being involved in outdoor recreation and education activities, yet - like nondisabled people - would greatly benefit from participating. In this study, we explore whether disabled people experience greater barriers or benefits to birding compared to nondisabled people. To understand what changes can be made to make birding and the outdoors more inclusive to those with disabilities, we analyzed responses from a survey administered by nonprofit Birdability (n=149) in 2021. The survey questions focused on changes that could be made to increase accessibility and inclusion to birding, and the unique benefits birders experienced as a result of being disabled. The top three changes noted that would make birding more accessible are 1) more accessible trails, 2) access to information, and 3) benches. The top three expressed unique benefits of being a disabled birder are 1) the ability to slow down, 2) enriched viewing opportunities, and 3) experiencing relationships with birds and/or nature. These results increase our understanding of the unique barriers and benefits of birding for those with disabilities and encourage experienced-based opportunities in birding through facilitating increased accessibility of birding locations and more inclusive birding experiences.

**Mentor(s):** Ashley Dayer (Department of Fish and Wildlife Conservation), Virginia Tech
Emily Sinkular (Department of Fish and Wildlife Conservation), Virginia Tech
Freya McGregor, Independent

**Jett Katayama**
Virginia Tech/Biological Systems Engineering

**Nicole Chapman**
Virginia Tech/Biological Systems Engineering

**Exploring Fluoride Impact and Concentrations in Well Water Across Virginia Counties**

Since the middle of the 20th century, public water fluoridation has been implemented in the United States to prevent tooth decay in humans. The Virginia Cooperative Extension currently estimates that 22% of Virginians depend on drinking water from a private source: most commonly wells. This project aims to explore patterns of naturally occurring fluoride in private drinking water in Virginia and provide information for homeowners to understand and manage fluoride in their wells. Water quality data from the Virginia Household Water Quality Program (VAHWQP), a Virginia Cooperative Extension program that offers water testing and education to private well and spring users, was used to map fluoride concentrations in over 20,000 private wells across Virginia to better understand the geographic distribution of fluoride in groundwater across the state. A concurrent literature review gathered information about fluoride's impact on dental health, cost, and public concern surrounding its addition to drinking water. Results were used to design an infographic to both educate the public on the risks and benefits of fluoride, and on the resources available to test and manage fluoride concentrations in their water. Information displayed includes the recommended range of fluoride in drinking water to maintain dental health, cost benefits of fluoridation, and maps which display the average fluoride concentrations in each county in order to highlight dangerously low levels. This infographic will assist Cooperative Extension in empowering private well owners to manage their systems to protect their health.

**Mentor(s):** Leigh-Anne Krometis (Biological Systems Engineering), Virginia Tech
Erin Ling (Virginia Tech Cooperative Extension), Virginia Tech

**Nikki Keith**
Virginia Tech/Biological Sciences

**Characterizing a 6.3 MHz High Frequency Endoscopic Histotripsy Device for Noninvasive Tumor Ablation**

Histotripsy is a non-thermal, non-invasive focused ultrasound (FUS) ablation method guided by real-time imaging. Histotripsy overcomes the thermal limitations of other FUS ablation technologies by using mechanical cavitation to emulsify tissue into acellular debris. Histotripsy is generally delivered at frequencies of 500 kHz to 1 MHz in cart-based systems. In this study, a 6.3 MHz high frequency endoscopic histotripsy system with a co-registered US imaging probe was developed for higher precision intraoperative tumor ablation. To characterize the microbubble behavior of the device, a series of cavitation behavior tests were performed inside 1% agarose tissue-mimicking phantoms at different pulse repetition frequencies (PRF) and peak negative pressures (p-). Bubble cloud dimensions were also analyzed at 1 kHz PRF for p- between 26-34 MPa using different cycle parameters. Results found the 6.3 MHz transducer could generate precise submillimeter histotripsy ablations with maximum bubble cloud dimensions ranging from ~0.35 ± 0.08mm to ~0.83 ± 0.24mm for 3 and 12 cycles, respectively. To demonstrate feasibility in tissue, histotripsy pulses from this system were delivered to various excised porcine tissues. Hypoechoic ablations viewed after treatment with US imaging demonstrated successful ablation of porcine kidney, liver, pancreas, brain, and lymph node samples, suggesting the 6.3 MHz system can be used for precise ablation of a wide range of tissues.

**Mentor(s):** Eli Vlaisavljevich (Biomedical Engineering and Mechanics), Virginia Tech

**Deniz Kesoglu**
Virginia Tech/Biochemistry

**Ian VandeLinde**
Virginia Tech/Physics

**Hope Callaway**
Virginia Tech/Plant Science

**Katie Beauchamp**
Virginia Tech/Microbiology

**Daniel Simms**
Virginia Tech/Physics

**The Effects of Different Genres of Music on Information Retention**

It is very common to see students play music when studying, and there is a decent amount of literature on what the effects of music are on certain activities such as learning. The purpose of this research was to determine what the effects of playing music were on memory retention in students. Specifically, we used 4 different music genres (i.e., lofi, hard rock, classical, control/no music). Participants were recruited from the Orion (science) Living Learning Community. In groups, subjects were given 7 minutes to read over a passage from the ACT while one of the musical genres was played. Subjects then received 5 minutes to read and answer 8 questions about the passage without referencing it and the music turned off. We found a negative correlation to memory retention performance and music being played. The control group did best with memory retention followed by lofi, classical, and hard rock genres. For future research, more music genres and their effects on memory retention could be tested. Additionally, we could test participant memory retention after being paired with their musical preference.

**Mentor(s):** Temperance Rowell (COS), Virginia Tech

**Tanisha Khopey**
Virginia Tech/Clinical Neuroscience

**Investigating the Correlation Between Peripherally Derived Monocytes and Neuroprotection Following Traumatic Brain Injuries**

Every year, millions of people of all ages suffer from traumatic brain injuries (TBIs), yet the mechanisms underlying neurotrauma and neuroprotection remain poorly understood. Previous clinical studies demonstrated that juveniles have better post-TBI outcomes compared to adults. However, the reason why juveniles have better post-TBI recovery is not yet known. One possible explanation for this phenomenon relates to peripherally derived monocytes (PDMs), which are immune cells that are capable of crossing the blood-brain barrier to reinforce microglial function and help regulate neuroinflammation. The purpose of this study is to investigate the possible contributions of juvenile PDMs to determine disparities between adult and juvenile patients. Using a controlled cortical impact (CCI) model, we measured lesion volume and monocyte cell counts in the cortex of both juvenile and adult mice post-TBI and compared them to mice who underwent sham surgery as a control. We hypothesize that juvenile PDMs confer neuroprotection by significantly limiting secondary injury due to neuroinflammation post-TBI when compared to mice with adult PDMs. We anticipate mice who receive juvenile PDMs will demonstrate reduced lesion volume and greater monocyte numbers. These findings would suggest that PDMs play an important role in the neuroprotection following TBI and provide a potential avenue for identifying novel therapeutic targets. Further research in the field of neurotrauma will be needed to fully understand the impact of immune cells on neuroprotection mechanisms, which could have important implications for future studies and potential treatments for TBI.

**Mentor(s):** Michelle Theus (Biomedical Sciences and Pathobiology), Virginia Tech

**Rowen Killeen**
Virginia Tech/Biochemistry

**Jack Horton**
Virginia Tech/Biochemistry

**Ethan Perkins**
Virginia Tech/Biochemistry

**Pablo Arevalo**
Virginia Tech/Biochemistry

**Dylan Toms**
Virginia Tech/Biochemistry

**Investigating the Affinity of an Antagonist on the Beta-Lactamase Receptor**

Beta-lactamase is the primary cause of antibiotic resistance to beta-lactam based antibiotics. The ligand of beta-lactamase, called ceftriaxone, hydrolyzes a bond in the beta-lactam lactam ring rendering it inert. To investigate the properties of the beta-lactamase ligand we docked the ligand ampicillin into the beta-lactam ring and compared the binding affinity, residue interaction, and fit into the binding cavity. Ceftriaxone, the original ligand of beta-lactamase, was also redocked in order to compare it with ampicillin. Webina version 1.0.3 and Pymol version 2.5.4 were used to bind the ligands into the cavity to find the affinity and residue interactions. The results of the docking simulation showed the differences in binding affinity between the two ligands The simulation revealed that ceftriaxone bound more effectively than ampicillin to the beta-lactamase structure. This suggests that ceftriaxone is very similar to ampicillin both in the structure of the ligand and the beta-lactam ring.

**Mentor(s):** Anne Brown (Biochemistry), Virginia Tech

**Rowan Killeen**
Virginia Tech/Biochemistry

**Pablo Arevalo**
Virginia Tech/Biochemistry

**Jack Horton**
Virginia Tech/Biochemistry

**Ethan Perkins**
Virginia Tech/Biochemistry

**Dylan Toms**
Virginia Tech/Biochemistry

**Investigating the Affinity of an Antagonist on the Beta-Lactamase Receptor**

Beta-lactamase is the primary cause of antibiotic resistance through beta-lactam inhibition. The ligand (Ceftriaxone) of beta-lactamase is necessary for the hydrolysis of peptide bonds.

If we replace Ceftriaxone with Ampicillin, ampicillin will bind with less affinity which will allow beta-lactamase to keep inhibiting causing diminished antibiotic resistance.

Beta-lactamase is the primary cause of antibiotic resistance to beta-lactam based antibiotics. To investigate the properties of the beta-lactamase ligand we docked the ligand ampicillin into the beta-lactam ring and compared the binding affinity, residue interaction, and fit into the binding cavity. Ceftriaxone, the original ligand of beta-lactamase, was also re-docked in order to compare it with ampicillin. Webina version 1.0.3 and Pymol version 2.5.4 were used to bind the ligands into the cavity to find the affinity and residue interactions. The results of the docking simulation showed the differences in binding affinity between the two ligands The simulation revealed that ceftriaxone bound more effectively than ampicillin to the beta-lactamase structure. This suggests that ceftriaxone is the superior ligand to support beta-lactams antibiotic resistance. This is important because manipulation of ligands within an antibiotic-resistant microbe can further our research into more effective antibiotics and medicine.

**Mentor(s):** Anne Brown (Biochemistry), Virginia Tech

**Katie Kirkpatrick**
Virginia Tech/Animal and Poultry Sciences

**The Effects of Phytase on 21-day Broiler Chicken Performance and Tibia Ash**

Phytase, an exogenous feed additive, is used in poultry to increase the digestibility of phosphorus (P) found in corn and soybean meal and reduce the need for supplemental inorganic P. An experiment was conducted to determine the effects of adding various concentrations of phytase to the performance and tibia ash of broilers from hatch to 21 days of age. Treatments included: a positive control (PC) with sufficient dietary nutrients (0.45% P and 0.92% Ca), a negative control (NC) containing reducing P and Ca (0.22% P and 0.71% Ca), and the same NC diet with 750, 1,500, and 2.250 FTU phytase/kg of diet. In total, 350 Aviagen 708 broiler chicks were assigned to each treatment using 14 replicate pens of 25 birds. Body weight was measured on day 0 and 21 along with feed intake and feed efficiency. Samples from 8 birds per pen were collected on day 21 to determine tibia ash, a measurement of skeletal P status. Removal of P and Ca from the PC diets to generate the NC diet reduced broiler body weight gain, feed efficiency and tibia ash in comparison to the nutritionally adequate PC diet. The addition of phytase to the NC diets resulted in body weight gain, feed efficiency and tibia ash values that were equal to or greater than those of the PC fed birds validating the effectiveness of the phytase and possibly suggesting an extra-phosphoric effect of phytase beyond increased efficiency of dietary P use.

**Mentor(s):** Micheal Persia (Animal Science), Virginia Tech

**Connor Klein**
Virginia Tech/Biochemistry

**Ryan Pho**
Virginia Tech/Biochemistry

**Carson Holdcraft**
Virginia Tech/Biochemistry

**Connor Riley**
Virginia Tech/Biochemistry

**Kenneth Chan**
Virginia Tech/Biochemistry

**A comparison of the effects of Huperzine A and Tacrine as inhibitors on Acetylcholinerase**

Acetylcholinesterase(AChE) is a cholinergic enzyme that regulates the breakdown of acetylcholine into acetylcholine and acetic acid. The excessive breakdown of acetylcholine results in the development of the neurodegenerative disease, Alzheimers. In this research, two ligands, Huperzine A and Tacrine, were compared to display a difference in function for the enzyme by testing its ability to dock into the enzyme. This was accomplished using Webina 1.0.3, which utilized redocking to measure and compare the different binding affinities. Both Huperzine A and Tacrine were fitted into the AChE model to where affinities were measured. The more negative the predicted binding affinities, the more favorable the compound binds to the enzyme. Using molecular docking, it was concluded that Huperzine A is more effective at inhibiting AChE, given a more negative affinity. The binding of this ligand and enzyme occurs at an active site of about 20 amino acids called the active site gorge. With the contribution of the catalytic triad(a set of residues of aspartic acid, histidine, and serine), hydrogen bonds, water bridges, and similar structures, the ligand can freely bind. It is from this that the group concludes Huperzine A is a more significant inhibitor in the binding of AChE.

**Mentor(s):** Anne Brown (Biochemistry), Virginia Tech

**Benjamin Kouzel**
Virginia Tech/Systems Biology

**Comparison and Validation of Frequently Used Molecular Docking Software Using a Diverse Ligands Set**

Protein ligand interaction drives organic life. Molecular docking is a computational tool used to simulate the interaction of a protein and ligand. In the literature that surrounds molecular docking, ligands that docking programs struggle with are not covered.

To better understand which ligands docking programs struggle with, we compared AutoDock4, AutoDock Vina, and Schrodinger Maestro Glide using redocking to see if they could successfully match experimental results. Five different crystal structures of protease bound to diverse ligands (PDB ID: 1XL2, 2P54, 3HL5, 3VZB, 3HL5) were used. RMSD calculations were performed to determine the successful redocking poses for each program.

AutoDock Vina was able to generate at least one pose per protein that was successful, though the larger the protein the less accurate it was, and the variation between its best pose and its worst pose was high. AutoDock 4 was able to consistently put out similar poses, however, it was not as accurate as AutoDock Vina or Glide, it also struggled with 2P54 due to its adjoining cycloalkanes. Glide was most accurate overall, though it performed worse than AutoDock4 with 1XL2, this was likely due to the non-linear nature of the 1XL2 ligand. Lastly of note is that every docking program struggled with 6LU7, due to its size.

The above-mentioned docking programs are not suited to ligands above forty atoms, Glide is recommended for straight stretched ligands and AutoDock4 for condensed ligands. These results provide pivotal insight into which docking programs are best suited to certain ligand structures.

**Mentor(s):** Anne Brown (Biochemistry), Virginia Tech
Erin Collins (Biochemistry), Virginia Tech

**Jenna Krebs**
Virginia Tech/Computer Science

**A Study of Exponent and Pramp as Technical Interview Preparation Tools**

Preparing for a technical interview can be stressful for software engineers, regardless of their level of experience within the field. First impressions mean everything in these contexts, and the demand for thoughtful and intelligent responses in a time-sensitive environment can add pressure to an already nerve-wracking situation. Fortunately, there are online resources, such as Exponent and Pramp, that are available for people who will be participating in technical interviews. These websites offer support in interview subjects such as data structures and algorithms, project management, behavioral, system design, front end, and data science. Users can choose which of these areas they would like to focus on and can brush up on their skills in advance of their interviews. This project explores software engineering with the goal of determining what role Exponent and Pramp play in helping software engineers prepare for interviews. The project looks at Google Analytics and survey responses then analyzes this data to determine who uses Exponent and Pramp and why. The results indicate that Exponent is most often utilized by first time users who are searching for interview questions and advice in obtaining non-entry level positions at different tech companies. Product management interview preparation was among the most popular of these upper-level positions being sought. Meanwhile, interviewees are visiting Pramp for its mock interviews and coding practice problems.

**Mentor(s):** Chris Brown (Computer Science), Virginia Tech

**Yullie Kwak**
Virginia Tech/Cognitive and Behavioral Neuroscience

**Jordan Teel**
Virginia Tech/Clinical Neuroscience

**Sebastian Ballesteros**
Virginia Tech/Psychology

**Lauren Meier**
Virginia Tech/Clinical Neuroscience

**Angel Appiadu-Manu**
Virginia Tech/Biochemistry

**Young Children's Interest, Self-Efficacy, and Curiosity in Robots throughout a Child-Robot Musical Theater Program**

Although robotic technologies have been increasingly accessible to young learners, a gap remains in terms of developmentally appropriate programs that integrate social robots with Science, Technology, Engineering, Arts, and Mathematics (STEAM) education in early childhood. We designed a 7-week child-robot theater program consisting of four modules (acting, dancing, music/sound, drawing) and conducted the program at a child care center in the United States. Among 47 children who attended the program, 23 children (17-65 months) participated in the research study, reporting their interest, self-efficacy, and curiosity in robots through the pretest and posttest for each of the four modules. Additionally, four classroom teachers were interviewed before, at the midpoint, and after the program to understand their perception of the program. Children's interest in robots remained high throughout the program regardless of the test period or module. Children's self-efficacy regarding robots improved significantly across modules. Children's curiosity in robots decreased only in the last module (drawing) from the pretest to the posttest. Teachers stated the positive effects of the robot theater program and the educational potential of social robots for children's cognitive as well as social-emotional development. The findings are discussed with respect to preschoolers' STEAM education and implications for young children's learning from interactive technologies.

**Mentor(s):** Koeun Choi (Human Development), Virginia Tech
Myounghoon Jeon (Industrial and Systems Engineering), Virginia Tech

**Caroline Larsen**
Virginia Tech/Electrical Engineering

**Emory Gleason**
Virginia Tech/General Engineering

**Acousto-Optic Nondestructive Inspection**

Nondestructive inspection (NDI) techniques are of utmost importance for evaluating the integrity of manufactured components and materials. Use of composites (e.g., carbon fiber) and additive manufacture (e.g., sintering) result in complex material structures that necessitate new evaluation methods, as damage mechanisms are often occluded or non-surface penetrating and thus not readily detected using conventional characterization techniques. The Acousto-Optic Nondestructive Inspection (AONDI) system will allow identification of subsurface flaws in a test specimen by characterizing the scattering of acoustic waves via an interferometric scan. This semester's work focused on aligning and testing the light interferometer subsystem, which consists of an optical path that projects collimated laser light onto two parallel slides. Various slide combinations and physical setups were tested in an attempt to create a light interference pattern; basic image processing of the collimated light region was also performed in order to amplify any optical fringes created by this interference. Once the interferometer is properly aligned, ultrasonic surface waves will be driven through the specimen and will perturb the interferometer plates, producing changes in the interference pattern that will be digitally processed and used to characterize defects in the specimen.

**Mentor(s):** David Gray (Department of Engineering Education), Virginia Tech

**Shane Lee**
Virginia Tech/Political Science & PPE

**Load Shedding in South Africa: How Solar Panel Deployment Can Alleviate Race-Based Inequalities**

I will explain why Solar panel deployment in South Africa is essential in remedying load shedding. Specifically, I will discuss how load shedding marginalizes Black South Africans in Townships and Rural areas. Load Shedding in South Africa is due to a high demand for energy and a tight supply. The current energy monopoly Eskom relies on coal and has limited the development of outside energy sources that can alleviate Load Shedding. Backed by the ANC (African National Congress), Load Shedding has been catastrophic for Black South Africans in Townships and Rural areas because of a lack of infrastructure and communication. However, I argue that Solar can alleviate Load Shedding and help disadvantaged Black South Africans due to the independence Solar provides. Currently, Amazon and the competing DA party (Democratic Alliance) are building solar panel infrastructure in South Africa to combat Load Shedding. Unfortunately, these plans don't include the interests of marginalized Black South Africans, which will lead to increased disparities Post-Apartheid. To remedy Load Shedding, Eskom, private businesses, and all political parties must unite on equitable Solar. As a Gilman Scholar in South Africa, I conducted in-person interviews and used scholarly papers to illustrate my point. I gathered my papers through the online database EBSCOhost provided by my college institution. Solar Energy is vital for Load Shedding, but it must include marginalized communities to be successful.

**Mentor(s):** Susan Bodnar-Deren (Sociology), Virginia Tech

**Jennie Lee**
Virginia Tech/Chemistry

**Adam Elnahas**
Virginia Tech/Civil Engineering

**Detection of Atmospheric Microplastic Fallout in the Southwestern Appalachian Mountain Region**

Global plastics production was estimated to be 367 million metric tons in 2020. A large portion of these plastic products become waste and are dispersed in the environment. Larger plastic fragments break down into miniscule plastic fragments called microplastics, which are typically less than 5 mm in size. Due to their small size and density, microplastics have been detected in urban, suburban, and even remote areas, suggesting the potential for long-distance atmospheric transport. Throughout this study, atmospheric microplastic deposition in and around Blacksburg, Virginia is investigated to determine the extent of microplastics fallout in the Southwestern Appalachian Mountains. A multi-day pilot study is carried out on the Virginia Tech campus to collect field samples using a stainless steel beaker passive sampler. Our sample preparation procedure includes a simple filtering process and organic matter digestion using hydrogen peroxide with heat to remove any contaminants and isolate microplastics in the sample. Our investigations show that the digestion step is essential because a large amount of organic contaminants were removed as confirmed by microscopy. Raman spectroscopy is carried out to detect/quantify microplastic abundance and composition. To track the origin and distance of the microplastic particles transported in the atmosphere, an air mass back-trajectory analysis using Hybrid Single Particle Lagrangian Integrated Trajectory (HYSPLIT) model is utilized. Guided by these preliminary findings, a larger-scale sampling study was designed and is currently in progress in conjunction with the National Atmospheric Deposition Program (NADP) to investigate atmospheric microplastics in the broader Appalachian Mountain region.

**Mentor(s):** Hosein Foroutan (The Charles Edward Via, Jr. Department of Civil and Environmental Engineering), Virginia Tech

**Emma Levon**
Virginia Tech/Biological Sciences

**Assessing the Impact of Predatory Amphibians on the Biodiversity and Community Structure of Invertebrates in Intermittent Ponds of the American Southwest**

This study aimed to observe changes in aquatic invertebrate community composition and structure in intermittent ponds of the American Southwest in relation to the presence of predatory amphibians. These data, as well as observations of tadpole presence at temporary ponds, will aid in answering questions such as: How does the presence of a predatory amphibian in an intermittent pond affect the diversity and structure of aquatic invertebrate communities? This region is predicted to experience increased frequency and severity of drought conditions, and understanding the drivers of community composition is an important first step in understanding community interactions within these intermittent ponds. Invertebrate community samples were collected once a week for four weeks from ten different temporary pond sites in Southeastern Arizona in the summer of 2022. Data was additionally collected regarding the presence of tadpoles and their respective species at these locations. The invertebrate samples were then processed, identified, and enumerated utilizing the Shannon and Simpson indexes as a means to understand the diversity and structure of the aquatic invertebrate communities and how the presence of a tadpole predator may shape the communities. Formal analysis of this data is forthcoming, but preliminary analysis does not show trends in invertebrate community composition.

**Mentor(s):** Meryl Mims (Department of Biological Sciences), Virginia Tech
Grace O'Malley (PhD student, Biological Sciences Department), Virginia Tech

**Meghan Lewton**
Virginia Tech/Wildlife Conservation

**Examining relationships between mother and cub jaguars from remote camera trapping data in Belize, Central America.**

Jaguars (Panthera onca) are elusive and notoriously difficult to study in the wild. However, remote camera trapping has made studying them possible. Jaguar cubs are even more rare than adults to observe, and their occurrence is not well known. Yet, knowledge of cub production can provide information on reproductive rates and give insight into the trajectory of wildlife populations. But, long-term data sets are required to document cub production, especially for long-lived species like jaguars. In this study, we used digital images obtained from a tropical broadleaf forest in Belize, Central America from 2014 to 2018, to document visual evidence of reproduction and determine whether presence of offspring in a population could be an index of reproductive rates, even for shorter-term data sets. We identified individual female jaguars by their unique spot patterns and recorded site location, date, number of images, and whether the image contained a cub (or both adult and cub). We also counted visual indicators of lactation or pregnancy status. We tallied counts and calculated proportions of total females, total females with cubs, and total females suspected to be lactating or pregnant. We conducted logistic regressions to quantify the strength of these indicators. We found that about 15% of females were detected with a cub at least once, but only 4.8% of total detections included cubs. Moreover, over 50% of individual females exhibited signs of lactation. This indicates that females may be having more cubs than we are able to document in remote cameras and suggests that indirect evidence of reproduction may be a better index of reproductive output than only direct detections of cubs.

**Mentor(s):** Marcella Kelly (Department of Fish and Wildlife Conservation), Virginia Tech
Rob Nipko (Department of Fish and Wildlife Conservation), Virginia Tech

**Baitong Liu**
Virginia Tech/Clinical Neuroscience

**Feasibility Study of Visitor Engagement Framework Assessing Informal Learning within University Settings**

Hokie for a Day is a field-trip aimed at increasing college awareness among Title I student populations in rural, Appalachian county areas. This program includes hands-on activities led by university staff, faculty, and students. The Visitor Engagement Framework (VEF), developed by Barriault and Pearson (2010), presents a tool for assessing learning in informal environments through observable behaviors. These behaviors exist within three discrete levels of engagement: Initiation, Transition, and Breakthrough. This framework was developed due to the difficulty of measuring informal learning as it is non-linear and there is a lack of measurable cognitive gains. The VEF was originally developed for science centers, but few studies have applied this framework outside of these environments. This study aims to explore the feasibility of applying VEF to informal learning environments on a university campus. The VEF fits well into this setting since each student spends a brief duration with exhibitors and observation does not impede the student‚Äôs potential learning opportunities or require student participation and time. A team of faculty, graduate, and undergraduate student evaluators have collected data using VEF over an academic semester. The team is employing code checking for credibility of data. Analysis of collected data is underway; however, preliminary results show 97% and 82% of students demonstrated learning behaviors consistent with Initiation and Transition respectively. A subset of students, 74%, displayed deeper learning behaviors consistent with Breakthrough. We hope to expand the utilization of the VEF to other informal learning environments and offer educators an alternative tool for evaluation.

**Mentor(s):** Chelsea Haines (Center for Educational Networks and Impacts), Virginia Tech
Ashley Costello (Doctoral Student - Higher Education, Center for Educational Networks and Impacts), Virginia Tech

**Andres Lopez**
Virginia Tech/International Studies

**Casey Branson**
Virginia Tech/Human Development

**Has your accent changed a LOT? Acquiring a Second Dialect as an English-Speaking Migrant**

Previous studies have shown that an individual's accent can change after living in another dialect region (see Siegel 2010), but researchers often find different degrees of second dialect acquisition depending on the particular variable being analyzed (Chambers 1992). In this study, we investigate the realization of the LOT vowel by English migrants to the US, and US migrants to England. We are interested in the vowel's phonetic realization: British speakers' LOT vowels are traditionally higher, and backer than Americans', and in this vowel's distinction from the THOUGHT vowel, since most speakers of US English have the cot-caught merger.

Data from this study comes from interviews with speakers in England and the US (Walker 2014), specifically 15 US-born migrants living in the UK, and 15 English migrants residing in the US, as well as non-migrant controls for each group. The interviews have been transcribed by hand and automatically segmented into phonemes using the Montreal Forced Aligner, and we automatically extracted duration, F1 and F2 measurements from all LOT and THOUGHT vowels that occur in stressed syllables, excluding instances that are followed by a coda nasal or liquid.

Our results suggest that US migrants in England may be slightly raising their LOT and THOUGHT vowels (i.e., becoming more English-like phonetically), but they are not unmerging these vowels. There is no evidence that English migrants in the US are becoming more American-like in their vowels; if anything, they are becoming more different after migrating to the US.

**Mentor(s):** Abby Walker (English), Virginia Tech

**Marion LoPresti**
Virginia Tech/Biochemistry

**Exploring the Dynamic Landscape of the NS2B/NS3 Protease in the Dengue Virus Using All-Atom Molecular Dynamics Simulations**

Positive-sense RNA including Dengue and Chikungunya viruses have a high rate of genetic recombination emphasizing a need for more efficient drug discovery methods and broad-spectrum antivirals. Integrating novel methodologies to functionalize and repurpose compounds with computational methods including virtual screening has been shown to increase the efficiency of drug design. Refining and elevating screening methods require a diverse set of structures to screen against to increase the potential success of computational hits. Proteases are promising targets for broad-spectrum antivirals due to their highly conserved catalytic site and crucial involvement in the replication and pathogenicity of RNA viruses. Considering the deficiency of structural data for these proteases, this study aims to investigate the efficacy of molecular-dynamics-generated structures for drug design. Molecular dynamics simulations performed on the crystal structure of the Serotype 2 NS2B/NS3 Dengue virus protease complex highlight the dynamic behavior of the NS2B cofactor. During simulation, the NS2B cofactor did not transition to its active conformation, limiting conformers for subsequent screening and mechanistic insight. Root Mean Square Fluctuations (RMSF) identified a dynamic area in the protease involving the residues present in the two β-hairpins of the NS3 protein proximal to the catalytic residues where the cofactor should anchor itself between in an active conformation. Future directions include molecular dynamics simulations with benzoyl-norleucine-Lys-Arg-Arg-aldehyde, a covalent inhibitor, to elucidate the mechanism of action of the NS2B/NS3 protease complex.

**Mentor(s):** Anne Brown (Department of Biochemistry, Program in Genetics, Bioinformatics, and Computational Biology, and University Libraries), Virginia Tech
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**Nicole Lydic**
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**Noah Prinzbach**
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**CJ Nance**
Virginia Tech/Psychology

**Joshua Farnsworth**
Virginia Tech/Psychology

**Interpersonal Gratitude and Subjective Well Being at Pedestrians Crosswalks: Demonstrating functional control of a practical intervention**

Due to the individualistic culture within the U.S., less gratitude has been observed over the years presumably due to an increase in entitlement and self-serving behavior. Expressing interpersonal gratitude increases subjective well-being (SWB) for both the benefactor and beneficiary. This field study investigated the impact of promoting an intervention on showing interpersonal prosocial behaviors within the community. This study integrated applied behavioral science and positive psychology by implementing a community-based prompting intervention to increase the frequency of pedestrians who demonstrated prosocial behavior, in this case, a wave, to the driver who stopped for them at crosswalks on campus. Research students sat unobtrusively next to targeted crosswalks, observed and recorded whether the pedestrians who crossed the street waved a “Thank you” to the vehicle driver who stopped for them. We used an ABA-reversal design to assess the impact of a simple prompting intervention, which was a sign placed at each crosswalk with the message, “Please Thank Drivers with a Wave”. This research design demonstrated functional control of the prompting intervention. Specifically, the overall mean percentage of waves during the observation sessions was 14.76% of 21,040 pedestrians during Baseline, 15.705% of 30,107 pedestrians during the prompting intervention, and 11.711% of 62,349 pedestrians during the second Baseline. However, the percentage of pedestrians thanking a driver was disappointingly low, reflecting an individualistic self-serving culture and a need for more interventions to increase the frequency of prosocial behavior and in turn, add positivity to the lives of individuals.

**Mentor(s):** Scott Geller (Psychology), Virginia Tech

**Kennedie Lyles**
Virginia Tech/Clinical Neuroscience

**The Detour to Tissue Viability: How Vasculotide Affects Blood Vessels Post-Stroke**

Ischemic strokes are characterized by a loss of blood flow to an area of the brain due to a blockage within a blood vessel and notably, the middle cerebral artery (MCA). Pial collaterals are arterioles that can bypass the occlusion and promote blood flow to the ischemic area. These collaterals are formed during development, and they exist prior to ischemic stroke. Under healthy conditions, pial collaterals are small and inactive. However, after a stroke, they become enlarged to reroute blood flow from the occluded vessel to the injured area. Tie2 is a receptor that when activated promotes blood vessel health and stability. Therefore, we hypothesized that stimulation of the Tie2 receptor with vasculotide, a memetic Angiopoietin 1 peptide and Tie2 agonist, would improve the pial collateral response after ischemic stroke. In vitro, Vasculotide significantly improved wound healing in scratched primary endothelial cells. To further assess the role of Tie2 after stroke, mice were treated with Vasculotide (3µg/kg) immediately after surgically induced stroke and euthanized 24 hours following administration. Compared to control mice treated with saline, tissue damage was significantly decreased 24 hours post-stroke in mice treated with vasculotide. Additionally, pial collateral diameter and endothelial cell proliferation was significantly increased 24 hours post-stroke in Vasculotide treated mice compared to controls. We concluded that the Tie2 agonist vasculotide improves pial collateral response and enhances the viability of tissue following an ischemic stroke, making it a novel therapeutic option for treating ischemic stroke.

**Mentor(s):** Michelle Theus (Neuroscience), Virginia Tech

**Piper MacNicol**
Virginia Tech/Chemistry

**Synthesis and evaluation of thermoresponsive copolymers for the extraction of rare-earth elements**

Rare-earth elements (REEs: Y, Sc, La – Lu) are crucial components in many electronics such as cell phones, green energy technologies, and batteries in hybrid vehicles. As these technologies become ubiquitous, the demand for REEs continues to increase, and consequently, efficient techniques for extraction and purification of REEs are in ever-increasing demand as well. To address this issue, polymers with metal-chelating properties present a relatively low cost, high affinity technique to selectively bind and extract REEs. A promising method for REE extraction is to pair metal-chelating functionality with stimuli-responsive functionality within a copolymer, allowing for facile extraction of the metal-polymer complex upon stimulus.

Poly(N-isopropylacrylamide-co-acrylic acid) (poly(NIPAM-co-AA)) is a copolymer containing a thermoresponsive moiety, N-isopropylacrylamide (NIPAM), and a metal-chelating moiety, acrylic acid (AA). We synthesized a series of poly(NIPAM-co-AA) polymers with varying NIPAM:AA ratios via a modular system, allowing us to keep key polymer parameters constant while only changing the co-monomer ratio. Reversible addition-fragmentation chain transfer polymerization (RAFT) of an activated ester monomer, 2,2,3,3-tetrafluoropropyl acrylate (TFPA) yielded poly(TFPA) with controlled molecular weights and low dispersities. Poly(TFPA) was derivatized with NIPAM and AA substituents via post-polymerization modification using isopropylamine and sodium hydroxide to hydrolyze the TFPA esters. The lower critical solution temperatures (LCST)-the temperature above which the polymer and chelated metal will no longer be soluble in solution- and metal binding ability of these co-polymers were studied as a function of copolymer composition using variable temperature UV-Vis spectroscopy. Preliminary variable temperature UV-vis spectroscopy results will be discussed.

**Mentor(s):** Michael Schulz (Chemistry), Virginia Tech

**McKenzie Marker**
Virginia Tech/Agribusiness

**Zachary Fulton**
Virginia Tech/Meteorology

**Audrey Hood**
Virginia Tech/Dairy Science

**Abigail Greenwood**
Virginia Tech/Dairy Science

**How Distance from Water Affects Cover Crops**

Cover crops are important tools in agriculture because they are planted to retain nutrients in the soil during non-harvesting periods. Our group sought to understand the best conditions for planting cover crops by understanding how distance to water (e.g., nearby river) affected the soil nutrients with and without cover crops present. It was believed prior to conducting our research that as distance from water increased, nutrients in the soil would decrease. Therefore, we collected soil samples using a soil auger from 24 different plots at Kentland Research Farm at varying distances from the New River which ran next to the plot; 12 planted and 12 unplanted. Each soil sample was put into labeled boxes and analyzed by the VT Soil Testing Lab. Based on the Soil Lab results, there were no notable differences between the planted and unplanted soil samples. However, the distance from the river affected the nutrient content of our soils on a nutrient-specific basis (phosphorus, iron, zinc, and potassium). It can be concluded that depending on the desired commercial crop, distance from the river (or another water source) would be beneficial to the health of the crop planted. Future research could include the examination of organic matter in the soil, this would mean that more time is needed for the current cover crops to begin decomposition.

**Mentor(s):** Temperance Rowell (College of Science - Orion LLC), Virginia Tech
Julia Gregory (Peer mentor (Microbiology)), Virginia Tech

**Shannon Mauro**
Virginia Tech/HNFE

**Selective genetic rescue of food intake, exercise, body weight and reproductive phenotypes in Nhlh2-knockout mice**

There is a strong nutritional and reproductive connection that has been acknowledged in science. However, the exact mechanisms of this connection are, as of yet, not well understood. The hypothalamic arcuate nucleus within the hypothalamus is important in the regulation of hunger, adiposity and metabolism, and it may also play a key role in nutritional impact on puberty and healthy reproduction. NHLH2 is a basic helix-loop-helix transcription factor that controls genes that regulate nutritional, exercise and reproductive phenotypes. Mice with a deletion of Nhlh2 knockout(N2KO), experience the effects of hypogonadism, adult-onset obesity, and low energy expenditure through exercise1. NHLH2 is expressed in neurons, especially within the hypothalamus, and has been found to play a major role in body weight regulation and reproductive health in both mice, and human patients with Prader-Willi Syndrome2. Further study into selectively rescuing Nhlh2's expression through genetic manipulation within the hypothalamus, may be one way to achieve body weight regulation through proper food intake, healthier reproduction due to balanced energy expenditure, and steady metabolic regulation in both animals and perhaps human PWS patients.

**Mentor(s):** Deborah Good (HNFE), Virginia Tech

**Jewel Mayo**
Virginia Tech/Human Nutrition, Foods, and Exercise

**Micronutrient Intake and Physiological Outcomes in Masters and Collegiate Athletes**

Objective: We examined the relationship between micronutrients and physiological outcomes in Masters and Collegiate Athletes.
Methods: The data we assessed are part of a larger cross-sectional study with Masters and Collegiate Athletes. We evaluated calcium, iron, magnesium, phosphorus, and zinc intakes and how they correlate with resting metabolic rate (RMR), maximal oxygen consumption (VO2max), and body composition. The micronutrient intake data were measured using a food frequency questionnaire. We also evaluated gender differences among these variables.
Results: A total of 415 Masters and Collegiate Athletes (210 women, 205 men) participated in our study (34.72¬±11.63 years [women: 36.39¬±11.29, men: 33.01¬±11.75 years]). Body mass index (BMI) for all athletes combined was 24.91¬±4.13 kg/m2 (women: 24.23¬±4.06, men: 25.62¬±4.09 kg/m2). For all athletes combined, magnesium (p=0.003), phosphorus (p=0.023), and zinc (p=0.041) intakes were significantly correlated with RMR. None of the micronutrients were significantly correlated with VO2max. Calcium (p=0.031), magnesium (p=0.002), phosphorus (p=0.004), and zinc (p=0.028) intakes were significantly correlated with bone mineral density (BMD). Calcium (p=0.014), magnesium (p=0.004), and phosphorus (p=0.0001) intakes were significantly correlated with lean body mass (LBM). We found significant correlations with iron and RMR (p=0.04) and iron and LBM (p=0.024) in men only.
Conclusion: Magnesium and phosphorus were the common micronutrients correlated with RMR, BMD and LBM. Iron was significantly correlated with RMR and LBM in men only. Prospective research on micronutrient intakes on RMR, VO2max, BMD and LBM in athletes are needed to more definitively ascertain how they affect these physiological variables.

**Mentor(s):** Stella Volpe (Dept of Human Nutrition, Foods, and Exercise), Virginia Tech

**Desraeli McBride**
Virginia Tech/Biological Sciences

**Invasive songbird behavior in urban and rural settings**

Human growth and spread has resulted in rapid ecological habitat disruption, commonly through urban development and introduction of biological invaders. Songbirds are an abundant and well-studied group but little is understood about how invasion and urbanization interact to impact biodiversity. Understanding how invasive species adjust their behavior to thrive in urban areas gives key insights into how they are likely to take hold within a novel habitat. This work seeks to explain how invasive songbirds behave differently in urban and rural settings with the goal of informing biodiversity conservation management practices. Behavior trials will evaluate how invasive and native songbirds respond to territory intrusion and novel stimuli in both urban and rural settings. Broadcast calls, soft songs, wing waves, time to touch, and time of interaction will all be recorded and statistical analysis will be used to find trends. It is expected that urban invasive birds will show greater aggression and boldness while rural natives will be more cautious. One pitfall is the potential for individuals to move between the two study sites. This can be resolved by conducting repeated trials to find general trends. Understanding the choices and interactions of an invasive species in different settings will help conservation managers recognize the early ecosystem signals and make management decisions quickly enough to conserve native ecosystem balances.

**Mentor(s):** Kendra Sewall (Biological Sciences), Virginia Tech

**Genet Mehari**
Virginia Tech/Biochemistry

**Anika Mansdoerfer**
Virginia Tech/Human Nutrition Food and Exercise (HNFE)

**The Role of eNOS in Mediating Stress Responses to Acute Aerobic Exercise in Liver**

This project aims to investigate the role of endothelial nitric oxide synthase (eNOS) in mediating the early responses to acute exercise within the liver. eNOS is an important enzyme that produces nitric oxide (NO), a potent vasodilator, in the endothelial cells of blood vessels. eNOS is particularly relevant to the liver, as it has been shown to mediate adaptations to chronic exercise in the liver (Cunningham et al., 2022). In this project, we seek to identify if eNOS mediates the acute stress responses associated with a single bout of aerobic exercise in the liver. We hypothesize that eNOS-derived NO may act as a signaling molecule to alter gene expression in the liver after acute exercise. Wild-type and eNOS knock-out mice were subjected to an acute bout of treadmill exercise, and three hours following exercise, their livers were harvested, homogenized, and underwent total RNA and protein extractions. The cDNA was synthesized from total RNA to measure gene expression using quantitative polymerase chain reaction (qPCR). To measure changes in protein abundance as it related to changes in gene expression, total protein was quantified using BCA assay, separated using SDS-PAGE, and subjected to Western blotting. We identified significant levels of gene expression ($p < 0.05$) for liver glycogen phosphorylase (PGYL) in wild-type exercised mice compared to eNOS knock-out exercised mice. This result implies that eNOS-derived NO may mediate the glycogenolysis pathway in the liver. Further research is needed to determine the molecular mechanism of NO signaling in the liver. Nevertheless, these findings might ultimately have important implications for the role of exercise in attenuating hepatic dysfunction.

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**AJ Lundberg**
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**Ben Kim**
Virginia Tech/Biochemistry

**Assessing the Impact of Lead Exposure on the Incidence of Psychopathic Genes**

Lead is a known neurotoxin and can therefore negatively affect normal psychiatric development in children. Brains suffering from psychopathy tend to have less gray matter in the amygdala, hippocampus, cingulate, and insular cortices. Since lead has a degenerative effect on the brain, we seek to find any correlations between lead exposure and psychopathy. In this proposed study, we aim to determine if there is a correlation between childhood lead exposure and the development of psychopathy over time. The main methods of conducting this project include an experimental study consisting of four mice models with varying levels of lead exposure and two age groups: 5 week old mice (young) and 3 month old mice (old). To study this phenomenon, we intend to inject 6.75 mg Pb/kg lead (1/20 of the Lethal Dose 50) into the young and old mice over the course of 10 weeks (Ibrahim et al., 2012). Another set of young and old mice will be used as negative controls. After 10 weeks, RNA isolation and quantitative polymerase chain reaction (qPCR) will be performed using a pre-established protocol (Tiihonen et al., 2020). We hypothesize that the CDH5 and OPRD1 genes will be down-regulated in mice exposed to lead based on prior research demonstrating this trend among incarcerated individuals exhibiting violent and antisocial behavior (Tiihonen et al., 2020). In the event that our hypothesis is confirmed, additional studies may be conducted in order to elucidate the effects of acute exposure to lead in early development.

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**Mentor(s):** Amanda Macdonald (University Libraries), Virginia Tech

**Lauren Meier**
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**Kaylee Botset**
Virginia Tech/Psychology

**Daily Alcohol use and Jealousy as Proximal Correlates of College Students,Äô Intimate Partner Violence.**

Alcohol-related intimate partner violence (IPV) theories posit that the likelihood of IPV perpetration after alcohol use increases when aggression-impelling factors (e.g., jealousy) are also present. Yet, jealousy has not been assessed at the daily level in relation to college students' alcohol use and IPV. We collected daily data on alcohol use, jealousy, and psychological, physical, cyber, and sexual IPV from college students (N = 236; 73.3% women) for 60 consecutive days. Controlling for baseline jealousy, average alcohol use, and sex, we evaluated whether IPV was more likely to occur on days in which alcohol use was higher than each individual's average (within-person effect), and whether these within-person effects were strengthened by higher (+1 SD) levels of daily jealousy.

The alcohol x jealousy interaction was only significant in the psychological IPV model (B = .08, p = .001). Unexpectedly, psychological IPV was less likely to occur as alcohol use increased, and the strength of this association decreased as daily jealousy levels increased (low jealousy model: B = -.27, aOR = .76; high jealousy model: B = -.17, aOR = .84). Daily jealousy positively associated with physical (aOR = 1.77) and cyber (aOR = 2.29), but not sexual, IPV. Alcohol use negatively associated with cyber IPV (aOR = .86) but did not significantly associate with physical or sexual IPV with jealousy included in the models. All ps < .01 in significant results.

College IPV interventions should target jealousy, which may be a more salient physical and cyber IPV predictor than alcohol use.

**Mentor(s):** Meagan Brem (Psychology), Virginia Tech

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Virginia Tech/Cognitive Behavioral Neuroscience

**Laura Zhang**
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Virginia Tech/Biochemistry

**Q&A on Zoom for preschoolers: The impact of on-screen partner's questions on preschoolers' word learning and memory of content from shared book reading over video chat**

Although preschoolers have been shown to benefit from reading over video chat with an on-screen partner (Gaudreau et al., 2020), what type of experience would maximize its instructional impact over time remains to be tested. In this study, we examined whether on-screen partner's questions during shared book reading would improve preschoolers' learning in general or specific to information targeted by the questions over two reading phases. Children ages 3-5 years (N=84) participated in a 30-min Zoom session where an on-screen adult read a storybook two times. The book included 5 novel objects-labels pairs and their locations. Children were randomly assigned to read the book either with questions (n = 43) or with statements (n = 41), both designed to highlight the object labels (not locations). Each reading phase was followed by a word learning test (target information) and a location memory test (non-target information). Results showed that children performed higher than chance in both word learning and location memory performance (p = <.05). Children's word learning performance was higher in the question than the statement condition (b = 0.57, p = .036), controlling for age (b = 0.04, p = .009) and trial (b = .71, p < .001). There were no significant differences in children's location memory performance by age, trial, or condition (ps > .05). Our findings suggest that preschoolers learn new words and remember content from the storybook reading over video chat. Critically, asking targeted questions can be an effective tool for teachers to support preschoolers‚Äô word learning in an online learning environment.

**Mentor(s):** Koeun Choi (Human Development and Family Science), Virginia Tech

**Emily Meluch**
Virginia Tech/Animal & Poultry Sciences

**Effect of In Ovo Feeding of Probiotics on Intestinal Cell Populations in Chickens**

Probiotics consist of live bacteria that colonize the gut and enhance gut health and development. Results from published studies indicate that probiotics may be stimulating an early immune response in the gut. The objective of this study was to use in-ovo feeding of probiotics to prime the chicken's immune response and alter the microbiome prior to chick hatch. In ovo feeding introduces compounds into the amniotic fluid of a late stage embryonic chick. The chick swallows amniotic fluid and thus in ovo feeding is a method of introducing compounds into the gut of the chick prior to hatch. A hole was punched in the shell of approximately 300 total eggs at embryonic day 17 and treated with no solution (Punch), 0.3 mL saline feeding (Saline), or 0.3 mL probiotic feeding (Probiotic). At embryonic day 20, day 1, day 3 and day 7 posthatch, the jejunum was collected and analyzed for mRNA expression of immune-related genes. The mRNA for IL-6, which is a proinflammatory cytokine, was upregulated with Probiotic compared to Punch and Saline. This showed that the probiotic initiated an inflammatory response. The B-cell marker Bu-1 increased with age, while the T-cell marker ALCAM decreased with age, but both were not affected by Probiotic treatment. The mRNA for Mucin 2, which produces mucus that lines the intestine increased with age, but was not affected by Probiotic treatment. In conclusion, the in ovo feeding of probiotics stimulated an inflammatory response, but did not affect expression of other immune-related genes.

**Mentor(s):** Eric Wong (CALS), Virginia Tech
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Sara Cloft (School of Animal Sciences), Virginia Tech

**Gabriel Mendelson**
Virginia Tech/Biochemistry

**Characterization of Mutations in AHASS2 in Arabidopsis**

Proteinogenic amino acids are organic compounds that constitute protein structure, and are vital for developmental and metabolic functions. Essential amino acids (EAAs) are a group of nine proteinogenic amino acids that monogastric animals cannot synthesize. Only plants, bacteria, and archaea can de novo synthesize EAAs. The EAAs Valine, Leucine, and Isoleucine are classified as branched-chain amino acids (BCAAs). Acetohydroxyacid Synthase (AHAS) is the first enzyme within the conserved BCAA synthesis pathway, which is inhibited upon binding of amino acids with its regulatory subunit (RSU), preventing over-synthesis of BCAAs. The AHASS2 gene encodes one of the two the RSUs, in Arabidopsis thaliana. Four Arabidopsis lines were obtained from a forward genetic screening for plants resistant to toxic concentrations of Val. These lines carry mutations in AHASS2. Mutations in AHASS2 might reduce the feedback inhibition of AHAS by BCAAs, enabling the mutant plants to exhibit higher resistance to Val.
For this hypothesis, I measured AHAS activity of mutant and wild-type plant extracts in the presence of BCAAs. Because AHAS is difficult to isolate for enzymatic assay measurement, I first optimized the extraction protocol to increase enzyme stability, as well as the throughput of the assay. The phenotype of the lines grown on toxic BCAA concentrations was determined and compared to their respective AHAS activities. Understanding the molecular regulation mechanism of AHAS activity would enable us to engineer more nutritious plant containing more BCAAs in their seeds and organs. This allows cost-effective and increased supplementation of BCAAs within commercial crops and livestock feed.

**Mentor(s):** Guillaume Pilot (SPES), Virginia Tech

**Allison Montgomery**
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**Madison Ruschaupt**
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**Sean Horner**
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**Isabella G. Oscaro**
Virginia Tech/Biological Sciences

**Nathan Ferguson**
Virginia Tech/Wildlife Conservation

**Plastic Degradation in Stream Habitats**

Plastic pollution poses one of the greatest environmental challenges, mainly due to the microplastics produced. Microplastics (particles <5mm) can be produced from plastic litter in aquatic systems due to mechanical abrasion, UV degradation or photolysis, chemical degradation, and hydrolysis. As a result, it is extremely challenging to predict or model the abundance of microplastic particles entering the environment. A common misconception of plastic debris is that it takes hundreds to thousands of years to degrade or mineralize. This underestimates the fragmentation that can occur along this period, contributing to varying microplastic production rates over much shorter time scales. Previous work has identified that within a salt-marsh habitat, macroplastics can start producing microplastics in as little as 8 weeks. In our assessment, we buried plastic items (n=5/polymer type) that represent common polymers found in the environment (polyethylene, polystyrene, polypropylene, polyethylene terephthalate, and polyvinylchloride) and natural cellulose debris (n=3/polymer type) in stream sediments from urban and forested areas to track the rate of fragmentation. To date, we have found through Micro Raman analysis that microplastics were being produced in as little as 2 weeks, faster than that observed in salt marshes in coastal systems. With a large emphasis on microplastic research focused on marine systems, it is important to note that ~80% of plastic debris comes from inland waters (streams, lakes, and rivers). With the fragmentation rate of microplastics being faster in these systems, it warrants more attention to the implications of microplastic pollution in freshwater habitats and its impact on human and environmental health.

**Mentor(s):** Austin Gray (Department of Biological Science), Virginia Tech

**Autumn Moore**
Virginia Tech/Agricultural Sciences

**Teaching Group Values of the Social Change Model Through Film: An Exploration of Student Perceptions of 12 Angry Men in an Online Leadership Classroom**

E-Learning has created a new challenge for leadership educators to teach online courses with accessible resources that engage students. 74 students in an online asynchronous introductory leadership course at a large land-grant university were assigned the film, 12 Angry Men, a free resource through the university library, as part of a weekly discussion post. The film depicts twelve jurors who must decide the fate of a young boy accused of murdering his father. Students were asked to (1) share their initial reactions to the film, (2) identify group values of the Social Change Model, and (3) observe any leadership they saw while watching. A thematic analysis was conducted based on the students' responses, and showed that a majority of students indicated that the film sparked their interest. Students were also able to identify the group value of collaboration when they saw the jurors working together to reach their final verdict. Most students also observed the leadership of one juror and his influence on the rest of the group, reflecting one of several positive leadership behaviors displayed throughout the film. The research team's goal was to provide leadership educators with an online learning tool that is accessible and adaptable to educate students on leadership and the values of the Social Change Model. Based on the findings of this case study, 12 Angry Men could be used as a resource for leadership educators to use in their online classrooms to provide students with a visual representation of complex leadership concepts.

**Mentor(s):** Austin Council (ALCE), Virginia Tech

**Trevor Moore**
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**Caroline Watts**
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Virginia Tech/Wildlife Conservation

**Annie Webster**
Virginia Tech/Wildlife Conservation, Fisheries Conservation

**Disappearing Voles - Least Weasel presence decreased vole observations in Mostela boxes**

Least weasels (Mustela nivalis) are the world's smallest carnivore. Due to their elusiveness, little is known about their life history and ecology, especially in Virginia. Due to their high caloric demands, least weasels are thought to frequently change feeding areas after they reduce prey densities. We pioneered using a new sampling technique, the Mostela box, in the United States, which uses cameras to study least weasels. From 2020-2023, we document least weasels on the Virginia Tech campus. Additionally, we also documented encounters of their main prey species, Meadow Voles (Microtus pennsylvanicus) and mice (Peromyscus sp.). We compared prey numbers before and after least weasels were observed in our boxes. Meadow Voles numbers greatly decreased after least weasel appeared, but mice numbers did not. However, if voles were not observed in boxes before least weasels, mice numbers decreased after least weasels appeared. Our results suggest that least weasels are preying on meadow voles if they are present and prey on mice in the absence of voles.

**Mentor(s):** Kevin Hamed (Department of Fish and Wildlife Conservation), Virginia Tech
W. Mark Ford (Unit Leader Cooperative Research Unit, Department of Fish and Wildlife Conservation), Virginia Tech

**Rachel Morse**
Virginia Tech/Wildlife Conservation

**Madeline Alt**
Virginia Tech/Wildlife Conservation

**Escaping a Glass Trap - Treated Glass Surface Can Provide a Solution for Shrew Mortality**

Glass containers are a source of mortality for small mammals throughout the world due to human littering. In Appalachia, discarded glass containers in the Cherokee National Forest are estimated to kill 1,000 shrew each year. Shrews are particularly susceptible to death due to their high metabolism and limited fat stores. Upon entering a discarded bottle, shrews quickly try to escape but are unable to gain traction and succumb to starvation within hours. Previous work speculated that bottles sitting in a position in which the bottle opening was greater than 15° above horizontal creates conditions where the shrew was unable to escape. We surveyed 0.9 km along Poverty Creek Road in the Jefferson National Forest, Virginia, and found 79 glass bottles of which 4 contained the remains of 9 shrews. To investigate a potential solution, we captured and observed 10 short-tailed shrews (Blarina brevicauda). Each shrew was allowed to cross a plain glass surface and we recorded the maximum angle at which the shrews could successfully traverse the surface. Also, we presented shrews with an etched glass surface and tested their ability to cross the surface. Shrews were able to climb plain glass at a maximum slope of 25°. Etched glass significantly increased the maximum angle that shrews could climb by 5-10°, thus providing a potential conservation solution to allow shrews to escape.

**Mentor(s):** Kevin Hamed (Department of Fish and Wildlife Conservation), Virginia Tech
Robert Bush (Department of Sustainable Biomaterials), Virginia Tech

**Rachel Morse**
Virginia Tech/Wildlife Conservation

**Madeline Alt**
Virginia Tech/Wildlife Conservation

**RJ Foster**
Virginia Tech/Wildlife Conservation

**Documenting Bird Mortality from Window Collisions on the Virginia Tech Campus**

Window collisions are one of the leading anthropogenic causes of avian mortality, with estimates ranging from 365 million to 1 billion deaths annually. Birds often collide when they see patches of sky or foraging cover depicted in reflective glass. We aimed to understand the nature of bird-window collisions on the campus of Virginia Tech with respect to timing, age of birds, frequency, and location. Over the course of three fall semesters, we surveyed 48 buildings 1-3 times a week; surveys consisted of walking the perimeter of a building and looking for evidence in the form of carcasses, feathers, or dust imprints on windows. We documented deaths of 57 species of birds and found evidence of collisions on 29% of surveys (n= 1291), and identified five collision hotspots on campus within which >60% of our successful surveys occurred. These areas along with a few minimal collision buildings have become the main focus of our investigations into this issue during the Fall 2022 semester. By identifying and continuing to monitor areas of greatest concern, we plan to offer the university informed guidance on where it can mitigate bird-window collisions.

**Mentor(s):** Kevin Hamed (Department of Fish and Wildlife Conservation), Virginia Tech

**Justin Moses**
Virginia Tech/HNFE

**Jimmy Anderson**
Virginia Tech/Clinical Neuroscience

**The Role of eNOS on Skeletal Muscle Adaptation During Exercise (Whole Gastrocnemius)**

Endothelial nitric oxide synthase (eNOS) is known to be a part of numerous metabolic regulatory processes during exercise. Previous research shows that exercise is a vital component to skeletal muscle adaptation. However, when it comes to skeletal muscle adaptation, the role eNOS plays is not fully understood. We hypothesized that eNOS is important to skeletal muscle adaptation during exercise through the production of nitric oxide (NO) which plays a role in the activation of important metabolic genes. To test eNOS role in skeletal muscle adaptation to exercise, we used wild-type mice (WT) and mice lacking eNOS (KO). Mice were randomly subjected to either sedentary cohorts or to an acute exercise protocol; 2 hour fast followed by a 1 hour treadmill run at 20m/s. 3 hours post-exercise, the whole gastrocnemius (WGC) of the mice were harvested. The WGC was frozen, pulverized, and underwent RNA extraction. The extracted RNA was used to synthesize cDNA, which inturn was used to perform qPCR analysis on exercise-responsive genes to quantify their expression. In order to determine the functional changes of our findings, that in response to exercise transcriptional changes appear to be eNOS-dependent, qPCR analyses were followed-up with Western Blot techniques to give us relative protein expression of selected genes of interest. Our data showed that post-acute exercise eNOS is required for Pgc1a expression. Pgc1a is needed for mitochondrial biogenesis and the remodeling of muscle tissue, supporting our hypothesis that eNOS is essential for skeletal muscle adaptation. Two other genes we tested, Catalase and Ulk1, are involved in antioxidant activity and autophagy respectively. In the absence of eNOS post-acute exercise, the expression of both of these genes increased, presumably to compensate for missing functionalities of eNOS.

**Mentor(s):** Siobhan Craige (HNFE), Virginia Tech

**Victor Mukora**
Virginia Tech/Computational Modeling and Data Analytics

**Application of Real-Time MLR to Predicting Solar Energy**

Mitigating the impact of weather conditions on photovoltaic (PV) panel performance holds tremendous promise for optimizing the operation of panel cooling systems, solar panel design, and general panel farm location selection. Consequently, by utilizing existing literature and our prior work in the field, we seek to develop a real-time solar panel monitoring system that offers both strong interpretability and effectual prediction. As such, we selected multiple linear regression (MLR) as our real-time predictive model. Utilizing the Wireless Vantage Pro2 Plus ISS weather station, a home-based solar panel, and Vernier Go Direct Energy sensor, we apply real-time MLR to help derive a greater understanding of the interrelated weather conditions and offer keen insights that enhance panel location, design, and relevant panel operations such as panel cooling, tracking, and maintenance. All data processing, filtering, cleaning, and predicting are performed in Python due to its compatibility with the Vernier and Wireless Vantage Pro monitoring platforms via the go direct package and Weather Link API v2 Python library, respectively. With Mean Absolute Error (MAE) as the model benchmark, the MLR models are saved at each time step to benchmark model performance against their next time block. To evaluate the merits of our models at each successive iteration, we enforce periodic replacement of existing data with newer readings to synchronize real-time data updates with our models' MLR algorithms. This work will help provide real-time optimizations in panel design, location, and prediction that aids energy stakeholders, corporations, governments, and general panel users alike.

**Mentor(s):** Anne Brown (Department of Biochemistry), Virginia Tech
Jonathan Briganti, Virginia Tech

**Neha Nauman**
Virginia Tech/HNFE

**How leaky gut causes autoimmunity**

Leaky gut syndrome is a microbial imbalance in the intestines that results in holes that allow for permeability and the leakage of particles in the bloodstream. Leaky gut syndrome often results in autoimmunity symptoms because the immune system recognizes native toxins and metabolites that it does not recognize and starts to attack itself. There is a lack of research on the specific native metabolites that result in leaky gut and immune system response. This study will probe this concept and use a specific kind of strain of mice and tag proteins in the intestinal cells to see what has passed through the membrane and caused “leaky gut”. This data will be compared to the autoimmunity characteristics of the mice to see how they are affected. It is expected that these mice will have particles that represent pathogens and they will lose characteristics of their normal cells, which will activate an immune response, causing autoimmunity. This work will highlight important steps needed to see how an impaired gut can result in autoimmunity based on the way the body reacts to the particles produced released from the leaky gut lining. Results from this work will allow us to study in depth how the different types of gut damage allows for different types of autoimmunity in the body, which is important to look at since the rate of the autoimmune diseases is rising by the year.

**Mentor(s):** Anne Brown (Biochemistry), Virginia Tech

**Jacob Newman**
Virginia Tech/Wildlife Conservation

**Designing Enrichment for Ectotherms at Disney's Animal Kingdom**

While traditional zoos were primarily for entertainment purposes, modern zoological associations are embracing ideas of conservation and education to support wildlife. Furthermore, institutions are using principles of choice, control, and enrichment to increase animal welfare and promote natural behaviors they would otherwise perform in the wild. With an interest in enrichment and bridging the spheres of zoos and wildlife conservation while gaining experience for my future career, I attended the Association of Zoos and Aquariums' (AZA) "Environmental Enrichment in Zoos and Aquariums" Course. This weeklong session at Disney's Animal Kingdom provided training on enrichment principles, modeling and evaluating designs, and implementing enrichment in exhibits. Working on the Ectotherms team, we created prototype enrichment for three different species: The Vinegaroon (Mastigoproctus giganteus), Sonoran Desert Centipede (Scolopendra heros), and Desert Hairy Scorpion (Hadrurus arizonensis). Respectively, we created a complex burrow system to allow for ease of access for keepers but privacy during breeding, a burrow to encourage digging behavior while staying in guest view, and a device to simulate prey behavior and encourage hunting. All projects were successful with both burrows being utilized and observing a successful hunt of one Emperor Scorpion (Pandinus imperator). This professional development experience has benefitted me by making connections and gaining skills so that I may encourage more keepers to implement these approaches.

**Mentor(s):** Kevin Hamed (Fish and Wildlife Conservation), Virginia Tech

**Molly Nystrom**
Virginia Tech/Biochemistry

**Hannah Hwang**
Virginia Tech/Biochemistry

**Eileen Wang**
Virginia Tech/Biochemistry

**Mia Argueta Lopez**
Virginia Tech/Biochemistry

**Zoe Johnson**
Virginia Tech/Biochemistry

**Acetylcholinesterase Mutagenesis: The Effect of a Non-polar R Group on Huperzine A's Affinity for the Active Site of the Enzyme, Acetylcholinesterase**

The enzyme acetylcholinesterase functions in cholinergic pathways and catalyzes the hydrolysis of acetylcholine into acetic acid and choline. Because acetylcholine is a neurotransmitter that is thought to mitigate amyloid plaques in the brain, acetylcholinesterase inhibitors are a primary treatment for Alzheimer's disease by increasing cholinergic function. The aim of the study was to determine if the polar amino acid in acetylcholinesterase, Histidine 440, when mutated to a nonpolar amino acid, alanine, led the ligand, Huperzine A to exhibit a lower affinity for the active site of the enzyme. Using Webina, a protein docking website, and Pymol, a molecular visualization system, the control and experimental data for the mutation was imaged and the binding affinity was determined. When finding the control, Webina was used to dock the ligand by adjusting the box size to the closest orientation. To mutate acetylcholinesterase, Pymol was used, utilizing the wizard tool and mutagenesis. The histidine 440 was mutated to alanine (ALA), the file was downloaded and transferred to Webina to find the experimental binding affinities. Across four trials, three trials demonstrated that the ligand had a higher binding affinity for the binding site of the mutated enzyme compared to the control. Three trials showed an affinity of -10.2 kcal/mol for the most ideal position of the ligand. The control had an affinity of -10.1 kcal/mol, exhibiting an affinity of .1 less negative than the three first three trials. The fourth trial, however, resulted in an affinity of -9.8 kcal/mol, which was less negative than the control and therefore displayed a lower binding affinity. These results generally indicate that mutating the amino acid histidine 440 to alanine causes a higher binding affinity of the ligand Huperzine A to the acetylcholinesterases‚Äô active site. This area is important to study due to acetylcholinesterases' role in inhibiting acetylcholine. Closely interacting residues such as histidine 440 could be the target of drugs to improve Alzhemier's patients' mental function.

**Mentor(s):** Anne Brown (Department of Biochemistry), Virginia Tech

**Lucy O'Brien**
Virginia Tech/Biochemistry

**Anastazja Kiselka**
Virginia Tech/Biochemistry

**Jordan Hale**
Virginia Tech/Biochemistry

**Megan Mansfield**
Virginia Tech/Biochemistry

**Isabellla Leathers**
Virginia Tech/Biochemistry

**Mutagenesis of Trytophan-293**

This research looks at the effect of mutating the aromatic tryptophan-293 into the nonpolar amino acid isoleucine on the ligand binding. The aromatic feature of tryptophan-293, which gives it both nonpolar and polar features, allows for an important feature called pi stacking. Pi stacking is the non covalent attraction between the pi bonds of an aromatic ring. Aromatic rings are compounds which contain benzene or other six ring carbon atoms. These are important for bonding because they allow for more pi bonds to form which makes the bond between the atoms stronger. It was hypothesized that if the aromatic tryptophan-293 was replaced with the smaller nonpolar amino acid isoleucine, then the ligand will have less affinity to the protein because the aromatic feature on tryptophan-293 is important in the binding of this ligand due to its aromatic ring and pi stacking. The techniques that were utilized in this study are PyMOL and Webina molecular docking softwares. The protein was docked into PyMOL using the PDB database file which allows the ligand and important residues to be recognized for redocking. The results of this experiment showed that tryptophan-293 allowed the ligand to bond more efficiently than with isoleucine. The values were slightly more negative in the affinity data sourced from Webina in the original protein with TRP-293 rather than in the mutated protein. The impact of this experiment could further expand our understanding of aromatic features on amino acids on ligand binding.

**Mentor(s):** Anne Brown (Biochemistry), Virginia Tech

**Megan O'Hara**
Virginia Tech/Microbiology

**Envelope Stress Factors Including Bile Salts Promote Increased Bacterial Twitching Motility**

The Yang lab discovered that MacConkey agar stimulates the twitching motility of Acinetobacter baumannii, an opportunistic human pathogen with increasing occurrence of multi-drug resistance. Twitching motility is a form of crawling bacterial movement mediated by the activity of the type IV pilus, which is a critical virulence factor for the pathogenesis of this bacterium. The goals of my research are 1) to determine which component(s) of MacConkey agar is responding to this stimulatory effect, if any, and 2) to examine the effects of bile salts and related envelope stressors on the twitching motility of Pseudomonas aeruginosa, another bacterial pathogen with alarming rates of antibiotic resistance. The results of this study will provide insights into the modulation of bacterial pathogenesis by environmental factors.
The parameters of this work include media composition analysis and inoculation methods as well as visualization and quantification of twitching motility. The techniques used include subsurface motility assays, minimum inhibitory concentration evaluations, spectrophotometry, imageomics, and the use of Excel. This study has determined that bile salts are the stimulant of twitching motility in Acinetobacter species and P. aeruginosa, potentially through envelope stress.

**Mentor(s):** Zhaomin Yang (Biological Sciences), Virginia Tech

**Leela Ohri**
Virginia Tech/Biochemistry

**Amelia Hegstrom**
Virginia Tech/Biochemistry

**Claire Robinson**
Virginia Tech/Biochemistry

**Logan Carolino**
Virginia Tech/Biochemistry

**Impact of Asn99Met on Glucokinase Binding Affinity for Glucose**

Glucokinase, a hexokinase, is an important enzyme in the regulation of glucose homeostasis, functioning as a glucose sensor within the liver and pancreas of the human body. The purpose of this experiment was to determine the effect, if any, of the asparagine to methionine mutation within the binding site of the glucokinase in Escherichia coli (E. coli). To measure the change, we maintained the ligand - the glucose - while mutating the asparagine 99 to methionine using PyMol 2.5.4. Then, the glucose was redocked into the mutated enzyme to determine change in binding affinity using the Webina 1.0.3. The mutated enzyme showed a greater binding affinity to the glucose than the original enzyme - an decrease to -6.3 kcal/mol from -5.9 kcal/mol. This indicates that the change in amino acids was beneficial for formation of bonds between glucose and glucokinase. Thus, it can be assumed that a mutation to methionine within the binding site has the potential to increase glycerol-3-phosphate (G3P) production. This substrate is used in the energy-producing reactions including glycolysis and respiration. Overall, the mutation to methionine has proven to be more effective energetically and leads to a greater efficiency in metabolic rate.

**Mentor(s):** Anne Brown (Biochemistry), Virginia Tech

**Seferina Olivo**
Virginia Tech/Environmental Resource Management

**Case Study of Urban Reforestation Efforts a Decade After Tornado Destruction of a Southwest Virginia Community**

On April 27th, 2011, an EF3 tornado passed through Glade Spring, Virginia carving a path of destruction 20 miles long and almost a mile wide. Hundreds of shade trees were heavily damaged or destroyed and this loss of trees motivated the local United Way branch to distribute tree saplings to heavily impacted households on the one-year anniversary of the storm. Glade Spring offers an opportunity to examine the ecological and social dimensions of small community forest restoration following a natural disaster. Small communities are rarely the subject of study for urban reforestation projects, and as a result, limited information exists on how to engage small communities in reforestation successfully.
We are investigating how the community forest has recovered from the tornado, what role tree planting has played in that recovery, and how community members feel about the reforestation efforts. Our team has been investigating these themes through a combination of remote sensing and geospatial analysis, a resident survey, and a tree inventory over the past six months. We anticipate a better understanding of replanting behavior after natural disasters, trauma perception as it relates to tree damage, level of arboriculture knowledge, what strategies were the most effective, and how communities can approach recovery from a natural disaster in the future. The strategies used should be replicable in other small rural communities and can contribute to the knowledge of how rural communities are affected by natural disasters.

**Mentor(s):** Eric Wiseman (FREC), Virginia Tech

**Esther Palmer**
Virginia Tech/Microbiology

**Characterization of a novel small regulatory RNA in Brucella abortus**

Brucella abortus is a Gram-negative bacterial pathogen that causes brucellosis in humans. Small RNAs (sRNAs) are less than 300bp in length, and regulate gene expression post transcriptionally, either positively or, negatively. sRNAs in B. abortus have been linked to virulence but have not been well characterized. Since B. abortus lacks many traditional virulence factors, further exploration into B. abortus's mechanisms of virulence is needed. A previous RNA-seq study identified a potential sRNA designated Bsr7, which was confirmed via northern blot analysis. Additional northern blot analyses in a ∆hfq background demonstrated that the stability of Bsr7 is not dependent on Hfq. Hfq is a protein that acts to stabilize sRNAs and facilitate the sRNA-mRNA interaction. A markerless deletion of bsr7 was made in B. abortus and a reconstruction strain was also generated to genetically complement the ∆bsr7 mutant. Deletion and reconstruction of the bsr7 locus were confirmed via northern blot. Disk diffusion assays determined that the ∆bsr7 mutant exhibits an increased sensitivity to the detergent SDS. Future studies are aimed at identifying regulatory targets of Bsr7, and for this transcriptomics and proteomics will be employed. Given that the ∆bsr7 mutant has increased sensitivity to SDS, a detergent that perturbs the outer membrane, any targets associated with the outer membrane will be assessed first. Altogether these studies have characterized a novel sRNA in the human and animal pathogen Brucella abortus.

**Mentor(s):** Clayton Caswell (Biomedical Sciences and Pathobiology), Virginia Tech

**Isabella Paolucci**
Virginia Tech/Geoscience

**Investigating magma sources that drive volcanic deformation in Tanzania**

The investigation of volcanic deformation provides valuable information regarding local tectonic and magmatic behaviors. Volcanic deformation in parts of the East African Rift System (EARS) provide insight into magmatic activity in early phase rifting processes. Located in Tanzania, Ol Doinyo Lengai is a prime feature to study due to its active tectonic region within the early phase Natron Rift of the EARS. My research focuses on investigating the volcanic deformation of Ol Doinyo Lengai, specifically modeling different magmatic source geometries. I use MATLAB to develop input files for the USGS code Coulomb version 3.4, then produce and output surface displacement file using the Coulomb 3.4 software. Once I have the surface displacement files, I plot them using the program Generic mapping Tools with shell scripting. Modeling both a spherical point source and a penny-shaped crack, the spherical source projected low magnitude deformation vectors center at source locations, whereas the sill model projected large magnitudes of surface displacement that were not centered at source locations. Since the penny-shaped crack source shows unrealistic deformation of unreasonable magnitude, I infer that the sphere is the more likely underlying source geometry driving the ongoing volcanic deformation of Ol Doinyo Lengai.

**Mentor(s):** D. Sarah Stamps (Geoscience), Virginia Tech

**Tyler Parker-Rollins**
Virginia Tech/Psychology

**Evan Alvarez**
Virginia Tech/Psychology

**Karina Daniel**
Virginia Tech/Psychology

**Isabel Motil**
Virginia Tech/Psychology

**Lana Nazzal**
Virginia Tech/Psychology

**Practical Interventions to Increase the Use of Reusable Bags for Groceries**

Without large-scale behavior change, the annual flow of plastic into the ocean will triple over the next 20 years, limiting climate regulation of the ocean and severely damaging both marine and terrestrial ecology. Unfortunately, most grocery-store customers choose single-use plastic bags over reusable bags. The present study evaluated the impact of a prompting and feedback intervention designed to increase the use of reusable bags at two large grocery stores. Baseline observations from January to March 2022, as well as September to December 2022, indicated that less than 14% of observed customers used reusable bags. Between April and May of 2022, we implemented a prompting/feedback intervention which placed large posters at the exit of two grocery store, with the phrase “Hokies, Choose to Reuse!” and the percentage of customers which used reusable bags during the previous week. Unfortunately, this intervention did not result in a significant change in behavior. In fact, we actually observed a decrease in reusable bag use across each cohort we studied (gender, age). This development prompted us to design a new intervention, which is currently being implemented here at Virginia Tech. This intervention targets members of Greek Organizations at Virginia Tech to promote the use of reusable bags, promoting intergroup competition and community awareness between organizations. The intervention is being implemented at the two grocery stores in a multiple baseline design, in order to show whether this intervention increases the use of reusable bags.

**Mentor(s):** E. Scott Geller (Psychology), Virginia Tech
Jack Wardale (Psychology), Virginia Tech

**Vittorio Pastore**
Virginia Tech/Mechatronics Engineering

**Juliana McIrvin**
Virginia Tech/Mechanical Engineering

**Development of a 3-phase, Affordable, and Modular 3D Printed Quadruped Robot**

Squeaky 2.0 is an updated and significantly more powerful version of Squeaky, a modular and affordable 3D-printed quadruped robot. Quadrupeds have unique applications for the field of robotics, but the typical cost of such robots prohibits their widespread use. Squeaky is designed to be almost entirely 3D printed in order to drastically reduce both the cost and manufacturing time of these quadrupeds and increase their usefulness as a research and educational tool. For this second iteration of Squeaky, we explored the shortcomings of the existing design with respect to the power requirement and the overall size of the robot. To achieve more complex tasks such as running and jumping, we replaced the existing servo motors with more powerful brushless DC motors in Squeaky 2.0. We used Siemens NX CAD software to redesign the body and legs to successfully incorporate the new hardware and improve the aesthetics of the design. We performed several design iterations to finalize the body and limb size, movement, and spacing for the design of Squeaky 2.0, which we then validated through 3D printing and prototyping. Squeaky 2.0 is currently undergoing final minor design revisions to ensure the functionality of the design, and after the assembly is completed, we plan to program and test the quadruped before releasing it as an open-source educational tool.

**Mentor(s):** Alexander Leonessa (Mechanical Engineering), Virginia Tech

**Madison Payne**
Virginia Tech/Biochemistry

**Making Food Babies: Generating Embryogenic Callus for Enhanced Food Production**

In order to feed the growing global population, we need to increase the rate of food production. While traditional breeding practices to select for agronomically important traits take years, biotechnology (e.g., gene-editing technologies) can make an instant, precise change, allowing for rapid development of crops with improved yield, disease resistance, or other beneficial attributes. However, in biotechnology, genes can only be modified in a single cell and not an entire plant. Regenerating a plant from these transformed cells proves to be a considerable challenge. Regeneration of plant tissue can be divided into organogenesis, the formation of organs (e.g., root or shoot), and embryogenesis, the formation of embryos. Organogenesis is a more time-consuming process, because first a shoot needs to be initiated before roots can be developed, requiring media transfers and specific media compositions. Comparatively, embryogenesis is similar to starting with a seed and can immediately develop a whole plantlet, both shoot and root. My project focuses on the development of a novel method to produce embryogenic callus from seeds of the model-plant Arabidopsis thaliana. We found after six weeks on high auxin (5µM 2,4-D) medium, the seedlings produced embryogenic callus that is able to be dissected and propagated. This method could be used for rapid regeneration of genetically modified plant cells and applied to other plant species in the future.

**Mentor(s):** Kelsey Reed (School of Plant and Environmental Sciences), Virginia Tech
Bastiaan Bargmann (School of Plant and Environmental Sciences), Virginia Tech

**Sarah Paz**
Virginia Tech/Civil Engineering

**Quantifying changes in extreme rainfall characteristics through time**

In a world already facing the consequences of climate change, designing infrastructure that resists worsening weather conditions is a growing priority. Different characterizations of rainfall intensity, including Intensity-Duration-Frequency (IDF) curves, can be used to inform the design of structures that are required to withstand extreme rainfall. This study aims to better understand how metrics of rainfall intensity in the mid-Atlantic region of the U.S. is changing throughout time and examines whether IDF curves reflect a changing climate. Precipitation data from the National Centers for Environmental Information consisting of hourly and daily intervals will be used to calculate a series of extreme rainfall metrics using 10-year intervals of data. Extreme rainfall metrics from nearby locations, provided by the NOAA's Atlas 14 project will be used to ensure the accuracy of the calculated curves. Each IDF curve will use a ten-year interval of a forty year span of data. This study will contribute to a growing body of research on whether climate change impacts IDF curves.

**Mentor(s):** Julie Shortridge (Department of Biological Systems Engineering), Virginia Tech

**Daniela Pereira**
Virginia Tech/Clinical Neuroscience

**Healthcare Inequities Among Disabled Groups in the U.S. Contextualized through Cerebral Palsy**

The pitfalls in the U.S. healthcare system are numerous and diverse, uniquely harming multiply-disabled groups like those with cerebral palsy (CP). Understanding the experience of people with CP in healthcare can not only help us to tackle the systemic problems within the healthcare system, but it can also help us contextualize and understand the larger social issues/beliefs that continue to enforce these disabling systems. This research is focused on outlining these pitfalls under two main categories: systemic and social barriers to healthcare. Systemic barriers result from our economic and political structure; these include insurance/hospital structure, the assistive technology market, and regional disparities. Social barriers result from dominant narratives of disability that can interact reciprocally with systemic barriers; these include misunderstandings of health and disability, perpetuation of normative over practical treatments, limited school/community support, racial/socioeconomic disparities, and limited reproductive/aging healthcare for people with CP. The current healthcare system penalizes people with health issues and disabilities to the point where we experience some of the worst health outcomes compared to other economically comparable countries. The purpose of this research is to 1) outline issues people with CP face with research and personal perspectives and 2) offer solutions based on these findings to more broadly support multiply-disabled groups.

**Mentor(s):** Ashley Shew (Science, Technology, and Society), Virginia Tech

**Victoria Pham**
Virginia Tech/Biology

**Preparation of A Guide to Common Poisonous Plants For Dogs in Virginia**

Everyday, canines are exposed to plants that are poisonous to them. This results in over 270 calls to Virginia's ASPCA hotline every year for dogs alone. The aim of this guide is to aid pet owners in avoiding or responding to poisonous plant exposure. The goal is to prevent problems before they occur and save pet lives. The guide is comprised of the top 15 genera according to the hotline. Here, I focus on the top five genera: Vitis, Allium, Prunus, Azalea, and Cannabis. According to the ASPCA hotline data, Vitis accounted for 1542 (30% of total cases), Allium accounted for 420 (8%), Prunus accounted for 276 (5%), Azalea accounted for 162 (3%), and Cannabis accounted for 135 (2.6%) of the cases. Exposure to grapes (Vitis) can result in vomiting, diarrhea, lethargy, kidney failure, and even death. The guide includes pictures of species within the top genera, as well as descriptions of their appearances, and look-alike species. Sections in the guide also specify where these plant genera can be found, either at home or in the wild. In addition, the guide lists symptoms that a dog might exhibit after consuming a specific part of the plant. This guide should help dog owners gain awareness of what plants are not safe for their pets and how to respond if their dog eats a toxic plant. The Metzgar Lab is also using a similar approach to produce a sister guide to poisonous plants for felines. Overall, my outreach project will save companion animals from a tragic and preventable fate.

**Mentor(s):** Jordan Metzgar (Biological Sciences), Virginia Tech

**Samantha Pham**
Virginia Tech/Biology

**Exploring the evolution of morphological diversity in two convergent lizard clades**

Urbanization is increasing and driving habitat loss for many species as well as increasing the spread of invasive species. Understanding how these animals will respond to these urban habitats could provide valuable information for how species adapt to these selection pressures. Our goal was to compare the macroevolutionary history of traits related to urbanization in two groups of lizards. We measured morphological traits for over 35 species of Hemidactylus such as toepad area and limb length. Then using data and publicly available data on anoles we analyzed the tempo and mode of evolution in these traits, comparing Brownian motion, Ornstein-Uhlenback (OU), and early bursts models. By running these models, we were able to determine which models fit each species best for a particular trait. For limb length, OU fit better for Hemidactylus and early burst fit better for Anoles. For the toepad area, we only measured and collected data for Hemidactylus. Running our measured data through the same models, we found that Brownian motion fit best for Hemidactylus toepad area. In the future, it would be ideal to use published data for Anole toepad area as well in order to compare the species' evolution. The results of this study are important because both groups contain invasive and urban tolerant species that have evolved differently over time. Our results could suggest that there are multiple ways to succeed in an urban environment although our findings have to be validated. With field studies. When combined, these studies could help to determine if macro-evolutionary history has any influence on contemporary responses to urbanization.

**Mentor(s):** Josef Uyeda (College of Science), Virginia Tech
Bailey Howell, Virginia Tech

**Alexandra Pinkham**
Virginia Tech/Microbiology

**Characterization of membrane-associated proteolytic cleavages during spore germination in Bacillus subtilis**

Bacterial endospores are formed upon nutrient deprivation. They are the most resistant forms of life on earth and can revert to their vegetative state when environmental conditions favor growth. In the vegetative state, some species like Bacillus anthracis and Bacillus cereus can produce toxins and cause serious diseases, such as anthrax and food poisoning, respectively. Bacillus subtilis is a non-pathogenic spore-former that is used as a model organism to study spore properties. SleB and CwlJ are B. subtilis Germination Specific Lytic Enzymes (GSLEs) important for the degradation of the cortex peptidoglycan during germination. Previous studies determined that SleB is stabilized by a partner protein on the inner spore membrane. During germination, YpeB is degraded by HtrC. Even in the absence of HtrC, YpeB was still degraded. The inner spore membrane proteome includes five putative proteases that might play a role in YpeB degradation: YugP, YmfF, YmfH, MlpA, and YtmA. We hypothesize that YpeB holds SleB inactive until germination starts, where YpeB degradation allows SleB to degrade the spore cortex. The aims of this project are to determine if the five proteases play a role in spore germination and to understand if YpeB cleavage is important for SleB activation. Multiple protease gene deletions were created in a ΔhtrC strain background. Assays were performed on the mutants to test for germination efficiency, and western blots were done to test for YpeB degradation. Preliminary results show that a strain lacking YugP and HtrC had a significant delay in germination, and another strain lacking five proteases except YmfH had a more significant and dramatic delay in germination for about 50 minutes when compared to a wildtype that germinated in 15 minutes. In conclusion, understanding the roles of proteins involved in germination may contribute to germination inhibition, allowing for effective spore decontamination.

**Mentor(s):** David Popham (Department of Microbiology), Virginia Tech

**Julia Place**
Virginia Tech/Human Development

**The stress of religion in queer young adults: A proposed study to evaluate the correlations between anxiety, Christian practices, and queer identity.**

Religious disaffiliation is growing in the U.S. every year, while rates of mental illness and those who identify as LGBTQ+ are increasing at comparably rapid rates. Llittle research has been done thus far exploring the intersection between queerness and religion, specifically Christianity. There are limited evidence-based interventions used for queer people suffering from either fundamentalist views or their religious community. Past studies have found that religiosity does not serve as a protective factor for LGBTQ+ people as it does for those outside of this community. Current research has employed relatively homogenous samples: often white, middle-class, and male. We will attempt to collect a diverse sample in regards to race, ethnicity, and gender expression The goal of this study is to learn from LGBTQ+ college students (an oft-ignored population) to explore the potential influences of their Christian upbringing on rates of anxiety. We will examine religious upbringing by utilizing semi-structured interviews and the Beck Anxiety Inventory. Students will be selected from Lavender House (an LBGTQ+ community at Virginia Tech) after a brief screening process. I believe that the effects of Christianity on queer people's mental health will be highly dependent on the religious practices that they choose to engage in. The psychological effects will be delineated as will future directions for research. These results may highlight the necessity of focusing on the role of religion and religious trauma in the lives of those who identify as LGBTQ+ and may help practitioners in alleviating minority stress for this population going forward.

**Mentor(s):** Anne Brown (Biochemistry), Virginia Tech
Ralph Hall (School of Public and International Affairs), Virginia Tech
Liesel Ritchie (Sociology), Virginia Tech
Nikki Lewis (Honors College), Virginia Tech
Rosemary Bliezsner (College of Architecture and Urban Studies), Virginia Tech
Rose Wesche (Department of Human Development and Family Science), Virginia Tech
Erica Grafsky (Department of Human Development and Family Science), Virginia Tech

**Yannick Pleimling**
Virginia Tech/Physics

**Photo-excited Magnetization Precession in Co/Pd Multilayer Films at Low Laser Fluence Regime**

I will present our study of optically excited precession of magnetization at the low laser fluence regime, as a function of magnetic field, in three Co/Pd multilayer (ML) systems. There has been little study on the low fluence regime (< 10 μJ/cm^2), and our approach could be a practical method for developing a non-thermal, all-optical magnetic switching toward low-power magnetic memory applications. The Co/Pd multilayers studied here have three regimes of magnetic anisotropy (in-plane, weak out-of-plane, and out-of-plane), and our results provided a better understanding of the relationship between optically excited precession and the interface anisotropy of Co/Pd multilayers. By employing time-resolved magneto-optical Kerr effect measurements, the connection of precession frequency and amplitude, Gilbert damping, and gyromagnetic ratio to the thicknesses of our MLs was explored. We have identified spin-orbit interactions affecting perpendicularly spin-polarized electrons at the Co/Pd interface to be the dominant mechanism for our observed variation in the oscillations' amplitude.

This study is based upon work supported by the Air Force Office of Scientific Research under award number FA9550-17-1-0341 and DURIP funding (FA9550-16-1-0358). This work was supported in part by TIT Research Abroad and Invitational Program for International Collaboration, and Grant-in-Aid for Scientific Research No. 18H03878. We also acknowledge the support of L. C. Hassinger Fellowship.

**Mentor(s):** Giti Khodaparast (Department of Physics), Virginia Tech
Brenden Magill (Department of Physics), Virginia Tech

**Mary Pletcher**
Virginia Tech/ISE

**Supran Poudel**
Virginia Tech/ISE

**Biomechanical Analysis in an AR/VR environment**

Engaging and effective ergonomic safety training is essential to reducing risks of workplace injuries such as WMSDs. Incorporating AR/VR into ergonomic training has been identified as a method for providing personalized and immediate feedback. However, little work has been done to demonstrate how detailed biomechanical outcomes when a worker performs a task can be used to inform the state of the user during training scenarios. This project aims to explore the feasibility of visually displaying biomechanic predictions in a VR environment based on motion tracking data. With more data on the user during training, the goal is to explore how detailed feedback can affect the user during manual material handling in terms of body movement and joint forces/moments. This may support future work developing a framework to facilitate personalized and real-time ergonomic training.

**Mentor(s):** Sunwook Kim (ISE), Virginia Tech

**Arijit Pradhan**
Virginia Tech/Neuroscience

**Exploring Nutrient Reward Learning in Obesity: A Pilot Study on the Signaling Pathway between the Gut and Brain**

Post-ingestive signals of carbohydrate availability are linked with reward learning in rodent models and healthy-weight humans. This carbohydrate signaling pathway may be altered in individuals with obesity, but no studies investigating nutrient reward learning in obesity exist. To address this gap, a pilot study with 12 participants aged 18-45 and BMI ranging from 18-35 kg/m2 is being conducted. In a crossover design, participants are exposed to flavored drinks containing either 75 calories of sucrose (CS+) or sucralose (CS-), a 0-calorie sweetener, 6 times each. One exposure session includes pre- and post-consumption measurements of blood glucose and insulin levels over 1 hour, and another session includes pre- and post-consumption measurements of metabolic rate and macronutrient oxidation. Pre-to-post changes in liking ratings, wanting ratings, and ad libitum intake are assessed as behavioral outcomes. We hypothesize that pre-to-post change in liking for the CS+ beverage will be lower for individuals with overweight or obesity, suggesting altered reward learning. We also hypothesize that individuals with obesity will have lower ratings of wanting and volume consumed f during ad libitum intake or the CS+ beverage. This is an ongoing study; preliminary data analyses are presented. Our findings will provide a better understanding of reward learning in obesity and may help identify potential novel therapeutic targets for obesity treatment.

**Mentor(s):** Alexandra DiFeliceantonio (Human Nutrition, Foods, and Exercise), Virginia Tech

**Audrey Prendergast**
Virginia Tech/Biochemistry

**Megan Fisher**
Virginia Tech/Biochemistry

**Emma Callaway**
Virginia Tech/Microbiology - Biomedical

**Maye Alyadinov**
Virginia Tech/Microbiology - Biomedical

**Zoe Johnson**
Virginia Tech/Biochemistry

**Investigating Effects of Socioeconomic Factors on Influenza Vaccination Coverage in Virginia Counties**

The influenza (flu) virus is an annually prevalent pathogen that is found throughout the world and vaccines are made each year to combat it. Public health officials often calculate vaccine coverage in a given geographical area to understand how access to flu vaccines can impact the health of different communities. Recent studies have shown there is a disparity between vaccine coverage throughout different geographical locations and socioeconomic factors like population size, income, and transportation access are involved. Therefore, our study aimed to understand these socioeconomic factors and vaccine coverage in Virginia. We collected socioeconomic data for counties in Virginia (sourced through the CDC, University of Virginia Cooper Center, DRPT Rail Database, Bureau of Economic Analysis). We evaluated trends using scatterplots with linear regression analyses and county vaccine coverage map overlaid with state transportation data. We found that there is a clear increase in vaccination coverage in counties with higher income, a possible increase in vaccination coverage in counties with higher populations, and no obvious correlation between transportation access and vaccination coverage. Further research should be conducted to assess if these results are consistent in other geographical locations in the United States and globally. Additionally, more research could be conducted in a time further from a global pandemic, which may have influenced the likelihood of vaccinations.

**Mentor(s):** Temperance Rowell (College of Science - Orion LLC), Virginia Tech

**Leila Pruscino**
Virginia Tech/Human Nutrition, Foods, and Exercise

**Chris Pereira**
Virginia Tech/Cognitive and Behavioral Neuroscience

**Kate McCarthy**
Virginia Tech/Psychology

**Alisha Dow**
Virginia Tech/Psychology

**Connected or Disconnected? Assessing Gender Differences in Students,Äô Screen Time and Its Effects on Perceived Social Support**

People are innately social beings, constantly seeking connection. So, it is not surprising that people utilize cell phones to stay in frequent contact with others. However, this study aims to examine whether increased cell phone usage actually has a negative impact on perceived social support. Perceived social support refers to the extent to which people feel emotionally supported by their friends, family, and loved ones. Virginia Tech undergraduate students completed a survey that consisted of three major components, the first being questions from the Multidimensional Scale of Perceived Social Support (Zimet, et al., 1988) to assess the perceived level of social support. The second component consisted of questions from the Big Five Personality questionnaire to identify an individual's level of extraversion and neuroticism. The third component asks students to report statistics on their device's screen time and social media application usage. In the Spring of 2023, the one-time survey was launched onto SONA Studies, a platform for undergraduate students to participate in research for extra course credit. The results from the study displayed that individuals who identified as female (n=164) showed to be more neurotic, conscientious, and agreeable than those who identified as male (n=43). The results also depicted that there was a positive correlation between females' messaging screen time and their perceived social support from their significant other. In contrast, for males, there was no significant relationship between messaging screen time and perceived social support from their significant other. The results from the present study suggest that females who have a higher messaging screen time may feel more supported by their significant other in comparison to males. Furthermore, the results indicate that gender plays a moderating role in the relationship between messaging screen time and perceived social support from an individual's significant other.

**Mentor(s):** E. Scott Geller (Department of Psychology), Virginia Tech
Jack Wardale, (Department of Psychology), Virginia Tech

**Simran Puri**
Virginia Tech/Psychology

**Temperament and Education Factors in Predicting Externalizing Behaviors in Middle Childhood**

Externalizing behaviors can be impacted by temperament and education. Research shows that negative affect (NA) is associated with externalizing behaviors (Zeman & Shipman, 1996). NA includes negative moods such as sadness (King et al., 1991). EC is a temperament trait of the child's ability to inhibit a dominant response (Rothbart & Bates, 1998) Evidence suggests that lower effortful control (EC) is associated with greater externalizing behavior (Olsen et al., 2005). Children with lower math achievement test scores exhibit higher levels of attention and aggression problems (Wu et al, 2014). The present study examined how NA, EC, and correct responses of Math and Reading in 6-year-olds impact on externalizing behaviors in 9-year-olds. Data was collected from 163 children.
NA and EC were measured via the CBQ-SF (Putnam & Rithbart, 2006). Math (MA) and reading (RE) correct responses were measured via Woodcock-Johnson IV (WJ). Externalizing behavior was measured via the CBCL (Achenbach & Rescorla, 2001). We used a two-step hierarchical regression analysis with NA, EC, MA, and RE as predictors. Step 2 (F= 15.237, p= <0.001) showed that NA (√ü=.333, p=<0.001), EC (√ü=-.314, p=<0.001), MA (√ü=-0.196, p=0.014), and the interaction of NA with EC (√ü=-.188, p=0.005) as significant predictors. Results indicate NA positively predicted more externalizing only for children with low levels of EC, lesser MA predicted more externalizing, and RE was not significant. Results suggest the importance of considering the interaction of temperamental traits along with math ability in the development of externalization.

**Mentor(s):** Martha Ann Bell (Psychology), Virginia Tech

**Morgan Rader**
Virginia Tech/Clinical Neuroscience

**Gender Diversity Among Neurodivergent Young Adults: Exploring Protective Factors**

There is increasing evidence suggesting a link between gender diversity and neurodivergence. Transgender and gender diverse individuals are at an increased risk for psychological health difficulties including suicidal ideation, life-threatening behaviors, and psychopathology. These risks can largely be attributed to the various stressors (e.g., non-affirmation, victimization) these individuals face. However, protective factors such as emotion regulation abilities and connectedness with family and peers can mitigate experiences of minority stress.

Given this backdrop, this study examined rates of gender diversity in a sample of young adults with a diagnosis of autism spectrum disorder (ASD) and/or attention-deficit/hyperactivity disorder (ADHD) relative to a sample of neurotypical youth, and whether neurodivergence and gender diversity status moderated the associations between emotion regulation abilities, community connectedness, and psychological well-being. Participants include 94 young adults (79 assigned female at birth), aged 18-23 years (M=19.71), 23 of whom identified as neurodivergent and 7 of whom identified as gender diverse.

Significantly more neurodivergent adults (26.1%) identified as gender diverse, relative to neurotypical adults (1.4%), $\chi^2 = 15.35$, $p < .001$. Multiple regression analyses indicated main effects for emotion regulation abilities and community connectedness in predicting depression, anxiety, and stress, but non-significant interactions for both gender diversity and neurodivergent status.

Results suggest that interventions targeting emotion regulation and connectedness would benefit the psychological well-being of all young adults, regardless of gender diversity and neurodivergent identity. Current findings should be interpreted within the context of the small sample size, particularly for gender diverse participants.

**Mentor(s):** Rosanna Breaux (Psychology), Virginia Tech

**Kiya Rahn**
Virginia Tech/Wildlife Conservation

**Domestic animal plant poisoning reports: an analysis of trends in Virginia from 2001 - 2021**

Companion animal poisoning cases resulting from exposure or suspected exposure to plant material are a common occurrence in the USA. Cultivated, native, outdoor, and indoor plants can all pose uniquely dangerous health risks to domestic pets. We examined a 2001 - 2021 dataset provided by the Animal Poison Control Center (APCC), a diagnostic and treatment hotline that condenses reports of pet poisonings and details them in the AnTox database system. Such toxicological events are characterized by poisoning agent, species involved, date, and location. The original collected dataset consisted of 111,276 records; after quality control and data filtering, plant-related poisoning records of domestic dogs and cats in Virginia accounted for 7.25% of the total call volume. Canines accounted for 73.6% of this subset, while felines accounted for 26.4%. Plant families Vitaceae (grapes) and Liliacae (lilies) were responsible for a remarkable 22.2% and 9.9% of plant call volume, respectively. Additionally, domestic animals exposed to harmful plant tissue were asymptomatic in 56.4% of cases. We further examined these data and found Falls Church City, VA to have the highest density of plant-related poisoning reports per capita. Finally, we used this dataset to compile non-technical guides to toxic plants in Virginia for cat and dog owners. Our findings reflect the importance of educating pet owners on the plant species they may encounter in or around the home that could endanger their pets.

**Mentor(s):** Jordan Metzgar (Biological Sciences), Virginia Tech

**Spruha Rami**
Virginia Tech/Computational and Systems Neuroscience

**Mosquito Larvae Ecology Mediates Central and Periphery Neural Encoding of Host Odors in Aedes aegypti**

The World Health Organization estimates that nearly 725,000 people each year are killed worldwide by mosquito-borne diseases. Female Aedes aegypti mosquitoes,in pursuit of human hosts for a blood meal to nourish their eggs, transmit pathogens causing diseases like dengue, Zika, and chikungunya. To find and locate hosts, mosquitoes rely on olfactory, thermal, mechanosensory, and gustatory cues. My research in the Vinauger lab specifically investigates how the growing conditions of juvenile mosquitoes (larvae and pupae) modulate the ability of adult females to employ olfactory cues when seeking hosts. To alter the growing conditions of juveniles, I rear larvae in low and high densities. Larvae reared in low-density conditions, in comparison with high-density conditions, emerged as large-sized adults. These large-sized females preferred host odors while small-sized adult females from the high-density condition showed no significant preference toward host odors. Interestingly, both large- and small-sized females showed a strong preference for CO2, a potent host cue. To further investigate the neural basis of these differential preferences towards host and plant odors, I performed electrophysiological assays while stimulating the female mosquitoes with host odors in the presence and absence of CO2. Findings from this study will inform us about the mechanistic relationship between larval growing conditions and adult mosquito behavior with strong epidemiological relevance. I am also working on integrating these results with other findings from the lab on mosquito physiology into mathematical models to predict disease transmission dynamics.

**Mentor(s):** Clement Vinauger (Biochemistry), Virginia Tech

**Tyler Rankin**
Virginia Tech/Animal and Poultry Science

**Maggie Terry**
Virginia Tech/Studio Art

**Grace Hugo**
Virginia Tech/Animal and Poultry Science

**Sam Burns**
Virginia Tech/Environmental Resources Management

**Abi Mountford**
Virginia Tech/Environmental Conservation and Society

**Cover Crop Seed Diversity's Effect on Overall Plant Diversity**

Cover crop diversity is important for maintaining proper soil health and assisting farm crops with growth by providing healthy nutrients. Our study was conducted within plots of land at Kentland Research Farm in Blacksburg, Virginia. Plant diversity was measured in 12 plots containing various cover crop species, with some plots containing only cereal rye, some containing only turnip, birdsfoot, and perennial ryegrass, and others containing only radish, turnip, perennial ryegrass, birdsfoot, and white clover. The data collected displayed both anticipated and unanticipated species emerging. Based on the observed data, there were a larger amount of species growing in each plot than originally planted. We used the Shannon Index, which estimates species diversity within an area, to determine the relative diversity in each plot. We found the numbers calculated for each plot were extremely low with none exceeding 2.0, the threshold for having a low diversity. We also found that as planned species numbers went up, the Shannon Index went up as well. Future research can be conducted to observe more plots for species diversity in different locations. Additionally, other factors could be studied to observe separate factors that affect crop diversity such as bacteria, abundance of plant biomass, soil nutrient concentrations, as well as mechanical means such as wind.

**Mentor(s):** Temperance Rowell (College of Science), Virginia Tech

**Trisha Ravigopal**
Virginia Tech/Psychology

**Maternal and Developmental Factors in Predicting Anxiety Problems**

The development of anxiety can be attributed to child and maternal factors (Dadds and Barrett, 2014). Greater anxiety symptoms may predispose individuals for developing an anxiety disorder. Longitudinal studies have found maternal behavior to be associated with increased anxious withdrawal and poor social development (Kawamura et al., 2014). These factors include maternal directiveness (MD) and negativity (MN). Child negative affect (NA) is associated with higher internalization (Rothbart & Bates, 2007). Finally, right frontal asymmetry (FA) is related to greater anxiety (Adolph & Margraf, 2017). The present study examined how MD, MN, NA, and FA in 4-year-olds predict anxiety problems in 6-year-old children. Anxiety was measured via the CBCL (Achenbach and Rescorla, 2001). The EATQ-R (Putnam et al., 2001) was used to measure NA. FA was measured using a 2-minute video baseline. Maternal behavior was measured during a child interaction task. We used a three-step hierarchical regression analysis with NA, MD, MN, and FA as predictors. Step 2 ($F= 6.946$, $p<0.001$) revealed that MN (beta=0.179, p=0.023), FA (beta=-0.156, p=0.037), and the interaction between NA and MD (beta=0.146; p=0.047) were significant predictors. Step 3 was not significant. Results indicate that child NA positively predicts anxiety problems only when experiencing higher levels of MD. Right FA and greater MN respectively predict for more anxiety problems as well. Findings suggest children that have more negative maternal involvement, greater NA, and right FA are at higher risk of developing anxiety.

**Mentor(s):** Martha Ann Bell (Psychology), Virginia Tech
Mohamed Zerrouk, Virginia Tech

**Tristan Reichard**
Blacksburg High School/Advanced Studies

**The Effects of the Placement of Hand Dryers on the Growth of Bacterial Colonies**

It has been well established that the use of hand dryers in public restrooms leads to a spread of bacteria. This experiment sought to suggest a correlation between the placement of hand dryers and their proximity to the bathroom and the amount of bacterial growth seen in the following days. 3 bathrooms were used for experimentation. In each bathroom, dishes were set out under 4 different conditions.
Conditions:
1. Hand dryer is inside the bathroom and dish is inside the bathroom (IHI)
2. Hand dryer is inside the bathroom and dish is outside the bathroom (OHI)
3. Hand dryer is outside the bathroom and dish is inside the bathroom (IHO)
4. Hand dryer is outside the bathroom and dish is outside the bathroom (OHO)
Procedure:
5 dishes were sampled under each condition for each of the 3 locations. The toilets were flushed, the hand dryer was run for about 5 seconds, and the dishes were opened for approximately 15 seconds each. The dishes were carried around the bathroom or outside the bathroom while open (depending on that dish's conditions.)
Results:
No noticeable differences in bacterial growth based on hand dryer position were observed. There was, however, a decrease in standard deviation when the hand dryers and the dishes were in close proximity. More specifically, the SD under IHI and OHO conditions was about .5, and it was about 1 under OHI and IHO conditions.

**Mentor(s):** Mark Williams (Agriculture), Blacksburg High School
Katherine Davis, Blacksburg High School

**Kathleen Reuwer**
Virginia Tech/Experimental Neuroscience

**Examining Astrocyte Plasticity and Synapse Formation in Rodent Whisker Barrel Cortex**

The TrkB.T1 receptor, a truncated isoform of the canonical TrkB receptor for brain-derived neurotrophic factor (BDNF), is predominantly expressed in astrocytes, an important glial cell type in the brain that intimately interacts with synapses. Recently, BDNF/TrkB.T1 signaling has been found to play a critical role in the morphogenesis of astrocytes (Holt et al., 2019). Since this discovery, how this signaling may also play a role in astrocyte and synapse interactions warrants further investigation. Using the rodent whisker barrel cortex as a model, we currently aim to determine how whisker enrichment alters the interactions between astrocytes and neurons at the synapse. We employed a global TrkB.T1 KO animal model to evaluate how loss of this receptor impacts the formation synapses. To evaluate astrocyte morphology, mice were injected with an adeno associated virus driven by the astrocyte specific GFAP promoter to deliver the expression of green fluorescent protein in astrocytes. They were then exposed to an environmental whisker enrichment before brain slices were tagged for various neuronal post-synaptic density markers along with vGluT2, a presynaptic terminal marker predominantly expressed in the whisker barrel cortex. Imaging and analysis were done to determine the colocalization of these tagged proteins. Preliminary results from the colocalization suggest that enrichment of the whisker barrel cortex enhances the colocalization, thus indicating more synaptic connections present among the astrocytes and neurons. This enhancement was not observed in TrkB.T1 KO animals providing preliminary evidence of the role of BDNF/TrkB.T1 signaling in astrocyte and synapse interactions. Understanding these aspects of the TrkB.T1 receptor will give further insight into the role of astrocytes in neurodevelopment.

**Mentor(s):** Michelle Olsen (School of Neuroscience), Virginia Tech

**Jordan Rhodes**
Virginia Tech/Biochemistry

**Jacob French**
Virginia Tech/Biochemistry

**Deniz Kesoglu**
Virginia Tech/Biochemistry

**Jasmonic Acid-Amido Synthetase (JAS) in Complex with Jasmonyl-Leucine**

Jasmonic acid-amido synthetase (JAS) is an enzyme commonly found in Arabidopsis thaliana which acts in part with the jasmonic acid and isoleucine hormonal pathway to induce cell protection, growth, and immunity. The common product of the enzyme is jasmonoyl-isoleucine (JAI), using jasmonic acid and an isoleucine conjugate. The aim of this study was to determine whether the enzyme can support and catalyze another type of amino acid conjugate, leucine, which has a different intermediate in synthesis than isoleucine, during synthesis. We determined this by performing molecular docking on a 3D model of the enzyme with its natural ligand jasmonoyl-isoleucine, and then determining the spatial positioning and orientation of the ligand. We then used Webina 1.0.3 to molecular dock  a closely related amino acid conjugate, jasmonoyl-leucine. This served to determine the binding potential of jasmonoyl-leucine and its relative affinity for bonding with the enzyme. We found that the isoleucine conjugate had a lower binding energy than leucine, indicating it binds more favorably to JAS. Through our study we concluded that jasmonoyl-isoleucine is the natural product of JAS because it is more energetically favorable than leucine. This project is important for understanding and determining potential alternative defense towards predator and environmental harm, especially in the instance of crop growth.

**Mentor(s):** Anne Brown (Biochemistry), Virginia Tech

**Owen Rubin**
Virginia Tech/Biological Sciences

**Heterologous Expression and Purification of NafZ glutaredoxin from Azotobacter vinelandii**

Azotobacter vinelandii is a model diazotroph for the study of nitrogenase which catalyzes biological nitrogen fixation. Transferring the capacity for nitrogen fixation to crops requires an in-depth understanding of the genetic requirements of formation and activation of nitrogenase. Many of these proteins have been extensively characterized due to their essentiality; however, several non-essential proteins still require further investigation. Some of the nitrogenase protein associated factors (Naf) which contribute to nitrogen fixation in A. vinelandii, such as the predicted glutaredoxin (NafZ), remain uncharacterized. The nafZ gene is located in the nifB operon, an essential gene for A. vinelandii growth under diazotrophic conditions. For my project I have used an affinity purification tag (called a strep-tagged) form of NafZ to aid in its purification. NafZ was heterologously expressed in Escherichia coli and purified using a strep-tactic affinity column. The purified NafZ showed a characteristic reddish color, indicating the presence of bound iron. These results lay the groundwork for future biochemical characterization of NafZ as well as the determination of its role in the nitrogenase assembly.

**Mentor(s):** Dennis Dean (Biochemistry), Virginia Tech

**Jeanna Saunders**
Virginia Tech/Animal and Poultry Sciences

**Relationship Between Methane Production and VFA concentration in Dairy Cows Fed with Ethanol-Based Feedstuff**

Replacing traditional fermentable dietary carbohydrates with unfermentable ethanol-based ingredients has the potential to allow ethanol to bypass the rumen and be absorbed directly into the blood; therefore serving as an alternative energy source which mitigates the production of methane. Using fresh sugar beets or ensiled sugar beets for dairy cattle consumption is a potential method for diminishing climate change concerns in the industry. The objective of this study is to determine if ethanol-based feedstuffs can mitigate methane emissions in lactating dairy cattle, in particular by using the associated volatile fatty acid (VFA) concentrations of different diets. Four rumen-fistulated lactating cows were assigned to a replicated 3X3 (treatment*period) Latin Square design consisting of one complete Latin Square and one incomplete Latin Square. Experimental diets were corn silage (CON), fresh sugar beets (SUG) and ensiled sugar beets (ETH). Three experimental periods of 21 days were conducted. Cows were fed in ad libitum regimen with a common diet 2x/day during the adaptation period and experimental diets 3x/day during the experimental period. Samples were collected prior to each subsequent feeding. Dry matter intake (DMI) was calculated as the amount of feed offered minus the amount of feed refused times diet dry matter. Rumen infusions of acetate, propionate, and butyrate were performed on days 11, 13 and 15; throughout these infusions rumen fluid samples were collected every hour, including an initial background sample. Jugular infusions of acetate and ethanol were performed on day 17 of each period; throughout these infusions, blood samples were collected every hour, including an initial background sample. All infusions were performed individually for 5 hours, with two infusions per day. VFAs from rumen and plasma samples were prepared and analyzed by GC-FID using a VFA Thermo Scientific gas chromatograph. Statistical analysis was performed in Rstudio using Tukey Contrasts and a mixed linear model, which accounted for the potential replication of treatments and periods (fixed effects) as well as the inability of the experiment to be replicated with the same animals (random effects). Significance was declared at $P \leq 0.05$ and trends at $P \leq 0.10$. DMI was found to be similar across diets ($P > 0.05$). Acetic acid concentrations yielded statistical significance between CON and ETH ($P < 0.01$) and SUG ($P < 0.01$), but not between SUG and ETH ($P > 0.05$). Propionic acid concentrations found no significance between CON and ETH ( $P > 0.05$), but significance between CON and SUG ($P < 0.01$) and SUG and ETH ($P < 0.01$). Butyric acid concentration varied between the diets with significance between CON and ETH ($P < 0.01$), CON and SUG ($P < 0.01$) as well as SUG and ETH ($P < 0.01$). Overall, the results suggest there may be some effects to a producer if switching to an ethanol-based diet; most notably in qualities related to decreased acetic acid concentrations. Further analysis is required to determine the impact of dietary treatments on milk and methane production.

**Mentor(s):** Mark Hanigan (Dairy Science), Virginia Tech
Leticia Campos (Dairy Science), Virginia Tech
Emma Hvas (Dairy Science), Aarhus University
Mogens Larson (Dairy Science), Aarhus University

**Peter Schiff**
Virginia Tech/Microbiology

**Dynamics of Tick-Borne Co-Infections**

Anaplasma phagocytophilum is an emerging, tick-borne pathogen that is expanding in distribution as the tick vector (Ixodes scapularis) also shifts in distribution. A. phagocytophilum may be detected in human co-infection with other tick-borne pathogens, such as Borrelia burgdorferi and Powassan virus. In this study we wanted to prepare to investigate experimental infections of A. phagocytophilum in Ix. scapularis. A. phagocytophilum was cultured in HL-60 cells to be used in the study. To infect naïve ticks with A. phagocytophilum, mice (C57BL/6) were inoculated with a needle-lysed solution of the pathogen via intraperitoneal injections. Ticks were then placed on the infected mice and allowed to feed until engorged ticks dropped off. Ticks were then transferred to ACL3 until their molt. A subset of the fed ticks was tested for A. phagocytophilum using real-time PCR. From the infected mouse-fed ticks, there were positive results that indicate successful acquisition of the pathogen during feeding. There was also success in finding A. phagocytophilum throughout the body of the tick. Simulating the transmission of tick-borne pathogens into their natural vectors allows for an understanding of how the pathogen can be acquired and develop inside the vector. Future investigations should look at the ability of co-infected ticks to transmit the pathogens onwards into hosts. These studies allow for a greater understanding of serious disease agents that are endemic in regions of the United States, with emergence in Virginia.

**Mentor(s):** Gillian Eastwood (Entomology), Virginia Tech

**Amelia Schmidt**
Virginia Tech/Animal and Poultry Sciences

**Public Outreach to Prevent Feline Poisonings in Virginia**

The Animal Poisoning Control Center (APCC) has recorded thousands of reports of feline poisonings due to plants in Virginia over the past 20 years. Many house and garden plants are toxic to cats, and these pets are at risk of interacting with toxic plants due to their behavior and curiosity. Owners must be aware of potentially toxic plants in their homes to properly ensure their animals‚Äô health and welfare. We compiled a guide to poisonous plants for cat owners in Virginia to increase owner efficacy in the identification of potentially toxic plant genera, as well as educate owners on the symptoms of plant generated toxicosis in felines. The guide addresses the 16 most reported plant genera recorded through the APCC, and provides information regarding plant identification and toxicological effects when ingested. Most plant genera cited in the guide were non-native ornamental plants. These ornamentals are common house plants, and are likely used in decorative settings such as in flower bouquets or kept for aesthetic purposes. The most common symptoms of toxicosis among all the genera noted include gastrointestinal tract and renal upset, nervous system disruption, throat and facial irritation, and cardiac dysregulation. Overall, the guide aims to provide owners with the knowledge about toxins their cats may be exposed to in order to prevent feline poisonings and ensure that their feline companion remains safe in their home environment.

**Mentor(s):** Jordan Metzgar (Biological Sciences), Virginia Tech

**Jane Sciortino**
Virginia Tech/Human Development

**The Impacts of the Virginia Tech Therapy Dog Program on Student Mental Health**

Mental health is a high priority for many college students. Virginia Tech's Animal Assisted Therapy program makes connecting to mental health care easier and more enjoyable. The therapy dogs and their handlers hold weekly office hours on campus where students can interact with the dogs and their peers. Students attending office hours completed an optional survey to determine the impact of this program. Within the survey, students shared demographic information and answered questions regarding their thoughts and feelings before and after office hours. The results showed that after visiting with the therapy dogs, students were in better moods, less stressed, and felt more connected to their community.

**Mentor(s):** Sarah Dunleavy (Thomas E. Cook Counseling Center), Virginia Tech
Teresa Wilson (Student Success Center), Virginia Tech

**Marina Scott**
Virginia Tech/Psychology

**Child Temperament and Parenting Behaviors Predict Adolescent Executive Functions**

Child Temperament and Parenting Behaviors Predict Adolescent Executive Functions
Marina Scott, Vanessa Díaz Benítez, Jennifer J. Phillips & Martha Ann Bell
Department of Psychology, Virginia Tech

Child temperament and parenting impact early childhood executive functions (EF). Temperament moderates sorting novel situations (De Mast, 2021). Additionally, parenting predicts EF. (Fay-Stammbach et al., 2014). The goal of our study was to examine these relations in adolescents.

Mother-child dyads (n = 75) participated when children were in middle childhood (T1) and adolescence (T2). At T1, children completed EF tasks- Backwards Digit Span (BDS; working memory), Wisconsin Card Sort Task (WCST; shifting) and Stroop (inhibition). At T2, mothers reported on non-supportive parenting using the Coping with Children Negative Emotions Scale (CCNES; Fabes et al., 2002)) and adolescents reported on negative affectivity (NA) using a temperament questionnaire (Ellis & Rothbart, 2001). ) and completed the same EF tasks as T1. Hierarchical regression was used to predict each of the three EF tasks at T2 (Step 1= T1 EF; Step 2 = T2 NA; Step 3 = non-supportive parenting).

For T2 BDS , steps 1 and 2 were significant. at T2. Both T1 BDS (B = .309, p = .007) and T2 non-supportive parenting (B = -.251, p = .036) predicted T2 working memory.). For T2 WCST, steps 1 and 3 models were significant. Both T1 WCST (B = .240, p = .043) and T2 NA (B = .242, p = .043) predicted T2 shifting. For T2 Stroop, step 1 was significant.

Results suggest different pathways to the components of EF during adolescence. Future research should focus on individual EF and parenting, rather than composite scores.

**Mentor(s):** Martha Ann Bell (Psychology), Virginia Tech
Vanessa Díaz Benítez, Virginia Tech
Jennifer J. Phillips, Virginia Tech
Martha Ann Bell, Virginia Tech

**Sarah Seay**
Virginia Tech/Biochemistry

**Structure-activity Relationship Study of Spns2 Inhibitors**

The transmembrane transport protein, spinster homolog 2 (Spns2), is responsible for the extracellular transport of sphingosine-1-phosphate (S1P).1 S1P is a chemotactic signaling molecule that promotes the directional movement of the lymphocytes towards the area of inflammation.2 Consequently, the S1P pathway is studied for its potential applications in treating kidney fibrosis, psoriasis, and multiple sclerosis.3 Previously, our group identified compound SLF0721169 as an Spns2 inhibitor with an IC50 of 350 nM in vitro. Herein, a structure-activity relationship (SAR) study exploring modifications to the nonpolar region of the previously identified Spns2 inhibitor is disclosed. The goal of this work is to improve the potency and in vivo activity of the inhibitor. Specific focus is given to the lipophilic region of the inhibitor to further improve activity and pharmacokinetic properties via the reduction of hydrophobicity and the number of rotatable bonds.

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We thank NIH for funding (R01 GM121075).

**Mentor(s):** Webster Santos (Department of Chemistry), Virginia Tech
Kyle Dunnavant (Department of Chemistry), Virginia Tech

**Caila Serrano**
Virginia Tech/Biological Sciences

**The ranges of Asplenium trichomanes ssp. trichomanes and Asplenium trichomanes ssp. quadrivalens south of the Pleistocene ice sheets**

Asplenium trichomanes (maidenhair spleenwort) is a popular fern in the horticultural trade and has different ploidy levels ranging from diploid to hexaploid. It has a wide global range from North America, Europe, Southeast Asia, and Australia, where it resides on rocky outcrops in colder climates. Virginia has two native subspecies of the maidenhair spleenwort that are morphologically similar: diploid A. tri. spp. trichomanes and tetraploid A. tri. spp. quadrivalens. The ranges and ecologies of both subspecies overlap, although A. tri. ssp. trichomanes prefers acidic substrates and more southern regions and A. tri. ssp. quadrivalens prefers calcareous rock and more northern regions. Thus, the best way to distinguish between the two subspecies is spore length. This is because tetraploid individuals have twice the DNA content of the diploids. We sampled spores from 130 herbarium specimens that were collected from below the southern limit of the Pleistocene ice sheets and photographed them using a Zeiss compound microscope. Spores were measured using ImageJ. We used the mean spore length to categorize the specimen as diploid or tetraploid. We have identified 89 specimens of A. tri. ssp. trichomanes, 29 A. tri. ssp. quadrivalens, and 12 specimens that could be either subspecies. Asplenium trichomanes has many ploidy levels worldwide, but the evolution of this complexity is unclear. This research is a step toward understanding the Asplenium trichomanes species as a whole.

**Mentor(s):** Jordan Metzgar (Biological Sciences), Virginia Tech

**Starlina Shepard**
Virginia Tech/Clinical Neuroscience

**Effects of the FAAH P129T mutation in mice on operant responding using FED3**

Drug addiction represents a worldwide health crisis, with well documented genetic influences. The mechanistic role of specific single nucleotide polymorphism (SNP) mutations in the development of addiction have not been explored. Here, we look at the P129T mutation in Fatty Acid Amide Hydrolase (FAAH), an enzyme in the endocannabinoid system that affects addiction-like behaviors. In this study, we analyze specifically the effect the mutation has on cognitive function involved with addiction-like behavior using humanized knock-in (KI) mice. We do this by evaluating decision making, adaptability, mental flexibility, and other complex brain functions. We study the effect of P129T mutation in female and male mice models using an operant feeding experimentation device to measure food intake and their progression through the experimental tasks. The addiction-like behavior tested in the animal models are cognitive flexibility, motivation, punished intake, and extinction/reinstatement. We find that the genotypes show no significant differences in cognitive flexibility. We find that P129T KI mice display lower motivation for palatable reward and these results are driven by females. For punished intake, the genotypes show no significant differences. Moreover, knock-in mice are less reactive to the termination of reward during extinction and have less extinction-bursts than wild-type (WT) mice. These results provide insight into how the P129T mutation impacts addiction-like behaviors.

**Mentor(s):** Matthew Buczynski (School of Neuroscience), Virginia Tech
Laura Murdaugh (PhD Candidate School of Neuroscience &Translational Biology, Medicine, and Health), Virginia Tech

**Zachary Sherman**
Virginia Tech/Geography

**An Upscaled Modeling Framework for Reactive Transport: A Case Study - Dry Creek, Idaho**

Rivers and streams are important for transporting minerals, nutrients, and other chemicals throughout the natural environment. Introducing potentially toxic species into local water systems, e.g. agricultural-based pesticides, may have negative ecological consequences. Hence, understanding how materials are transported in hydrologic systems is important for developing more sustainable water management practices. The goal of this research is to validate a mathematical model that faithfully captures the transport of a reactive solute plume in a turbulent open channel with hyporheic exchange. To this end, field scale conservative (NaBr) and reactive tracer (NaNO3) experiments were conducted in Dry Creek, a small tributary in the Boise River watershed located in Idaho, USA. Reactive and conservative tracers were (pulse) injected into Dry Creek, and breakthrough curves were measured at 5.27m and 70.64m from the injection site. Here, we present analysis and results of the field study, linking creek characteristics to transport behavior. Then we develop a upscaled linear-reactive transport model using a CTRW framework to validate field study results. We compare the upscaled mathematical modeled breakthrough curves with observational measurements and use model insights to characterize the underlying governing process of reactive transport at the reach-scale. Specifically we explore the impact of the underlying sediment bed on channel transport in both the reactive and conservative cases.

**Mentor(s):** Thomas Crawford (Geography), Virginia Tech
Kevin Roche, Boise State University

**Elyse Shoppell**
Virginia Tech/Biological Sciences

**Small Protein, Big TARGET: Transient Assay Reporting Genome-wide Effects of Transcription Factors**

Gene regulatory networks are critical for understanding biological systems. The identification of the direct target genes of transcription factors is critical to resolving gene regulatory network structures. Transient Assay Reporting Genome-wide Effects of Transcription factors (TARGET) is a system that allows identification of the direct target genes of transcription factors in vivo. Here, I present a concept to address a current limitation of the TARGET system.

The original TARGET system requires the fusion of the transcription factor to a receptor, keeping it localized outside of the nucleus until the application of the required ligand. To isolate only direct targets, a translational inhibitor is used to block translation of transcribed mRNA. Using RNAseq, the transcriptome can then be analyzed to identify specific genes targeted.

Preliminary results indicate that the receptor used in the TARGET system interferes with the function of transcription factors. Here, we describe a modification to the TARGET system using a photocleavable amino acid sequence combined with a membrane localization signal. This keeps the transcription factor of interest out of the nucleus until its exposed to a specific wavelength of light allowing it to enter the nucleus.

The TARGET 2.0 system is potentially a more versatile way to isolate the effects of specific transcription factors. The new system is more applicable and could be useful for our current research as well as others. We are currently exploring and testing different membrane localization proteins to further improve the system. Additionally, we intend to further explore additional uses for photocleavable amino acid sequences in protein interaction studies.

**Mentor(s):** Bastiaan Bargmann (School of Plant and Environmental Sciences), Virginia Tech

**Colin Short**
Virginia Tech/Biochemistry

**Production of Butyrate from Inulin by Co-culture with Coprococcus eutactus, Lactobacillus plantarum, and Methanobrevibacter smithii**

We are studying how three microorganisms from the human large intestine interact biochemically in an in vitro system. Lactobacillus plantarum and Coprococcus eutactus together generate butyrate that is the main energy source for epithelial cells and plays a role in anti-inflammatory gene regulation which keeps the gut healthy. Methanobrevibacter smithii thermodynamically assists the process by consuming the hydrogen liberated by the two bacteria and coverts it to methane. We have set up an in vitro mixed culture using inulin as the polysaccharide because it is only degraded in the large intestine and is not absorbed by the small intestine. This experiment will track fructose production alongside butyrate and methane.

**Mentor(s):** Biswarup Mukhopadhyay (Biochemistry), Virginia Tech
Bela Haifa Khairunisa /(Biochemistry), Virginia Tech

**Nabeel Siddiqui**
Virginia Tech/HNFE

**Abhinav Krishnan**
Virginia Tech/Biochemistry

**The Role of Endothelial Nitric Oxide Synthase (eNOS) and Exercise in Skeletal Muscle (Quadriceps)**

The goal of this project was to elucidate the potential mechanisms by which endothelial nitric oxide synthase (eNOS) influences gene expression in the skeletal muscle, specifically the quadriceps from C57BL6J wild-type mice. eNOS is an enzyme that produces nitric oxide (NO). Among skeletal muscle tissues, NO has a major role in the vasculature. Previous studies have shown that low levels or decreased activity of eNOS causes vascular dysfunction. To understand the potential role of eNOS signaling in driving skeletal muscle gene expression in response to exercise, mice were subjected to an acute exercise treadmill protocol. Both wild-type and eNOS knock-out (KO) mice were utilized. Following the running protocol, the quadriceps muscles were harvested 3 hours post-exercise. Then, changes in mRNA levels were measured using real time quantitative polymerase chain reaction (qPCR), with GAPDH as the housekeeping gene. The lack of eNOS was expected to lead to altered levels of exercise-responsive genes following an acute bout of exercise. Based on previous literature specific genes such as Sik1, Pgc1a, Nox4, Alas1, Nr4a3, and Atf3 were chosen to be analyzed. The exercise responsive gene, Sik1, significantly increased with exercise in both WT and eNOS KO mice, demonstrating both groups underwent constant treatment conditions. Further, levels of another exercise-responsive gene, Nr4a3, appeared to be elevated in only the WT condition. This suggested nitric oxide from eNOS might direct the transcriptional response to exercise through the regulation of Nr4a3 gene expression. Based on this data, it is clear further research needs to be conducted to elucidate the relationship between Nr4a3 and eNOS.

**Mentor(s):** Siobhan Craige (HNFE), Virginia Tech

**Sophia Silis**
Virginia Tech/Psychology

**Addison Midkiff**
Virginia Tech/Criminology

**Sheryk Luna**
Virginia Tech/Criminology

**Performances to Reduce Online Scams (PROS): Evaluation of targeted intervention against scams of older people**

The issue of geriatric scamming, the targeted financial exploitation of older people, is imperative to investigate because the American elder population is steadily increasing; by 2060 1 in 4 Americans will be part of the population over 60 (US Census Bureau, 2020). Yet, age specific prevention and awareness raising programs are not available or are not evaluated. Therefore, our research is necessary to develop effective interventions which address the impact of scams on the well-being and quality of life of older adults. The Performances to Reduce Online Scams (PROS) ICAT-funded project aims to collect data directly from older adults and offer targeted assistance in preventing online scams. The goal of the project is to understand how different populations react to the educational play, “This is Not a Scam!”, including elderly, professional, and public groups. By exploring these reactions, the project team assessed the effectiveness of the intervention and identify areas for improvement. To achieve this goal, the project has conducted quantitative survey data collection and qualitative observational research of theatre attendees about their experiences and responses to the play. Through thematic coding and multivariate cross tabulation, the project team will inform the development of targeted interventions tailored to the needs and experiences of older adults. The current quantitative study has shown that retirement populations are the least knowledgeable about signs of scamming. This illustrates that older people exhibit a lack of scam awareness, and necessitates the need for current research on geriatric scamming interventions. Our qualitative findings suggest that the educational play was least successful within the oldest and youngest demographics. Further, this finding shows that our target population for interventions going forward should be focused on older adults ranging ages 61-75 years old.

**Mentor(s):** Katalin Parti (Department of Sociology), Virginia Tech

**Andrew Sloop**
Virginia Tech/Public Relations

**Conversate: Community Viability, Growth, and Opportunity**

Communities continuously change in a global environment as we encounter challenges revolving around the demographic, economy, identity, and well-being of each individual, thus increasing the challenge of having engaged, robust, equitable and sustainable communities. Our objective is to identify the constructs of a viable community, interpret the data, and develop and implement an action plan with the support of Virginia Tech resources, workshops, and programs across multiple university departments to create a viable community in the Leadership and Social Change Residential College and Lavender House, located in O'Shaughnessy Hall.

To continue the tradition of Ut Prosim (That I May Serve), we must establish viable communities that are willing to grow as a collective and accomplish innovative goals in the spirit of the Hokie nation. Survey participants rated statements related to community viability as accurately as possible to reflect their perceptions of the communities in O'Shaughnessy Hall. The survey included three categories to indicate community viability: community sentiment, community vision and capable community leadership. A Likert scale was utilized with 21 statements. Respondents checked strongly agree, agree, neither agree nor disagree, disagree, and strongly disagree. Construct scores were additive for all statements within the construct. A response of "strongly agree" received a score of five while a response of "strongly disagree" received a score of one.

This research examined community perceptions of community viability in O'Shaughnessy Hall in the spring semester of 2023. The data have been analyzed and will be used to make recommendations to the community to grow in the three community viability categories of vision, leadership, and sentiment. We also measured perceptions of infrastructure and will use this data to consider the impacts of this construct on the other constructs.

We intend to employ focus groups to develop a deeper understanding of community members perceptions and to ask questions that pertain to a specific issue in the community that influence community viability. We will gather information from the focus group(s) allowing opportunities to bring Virginia Tech programs into the community to support community sentiment, community vision, and capable leadership. By conducting this research with a residential college at Virginia Tech, we hope to be able to learn how effective programming can develop viable communities on our campus.

**Mentor(s):** Rick Rudd (Agriculture, Leadership, and Community Education), Virginia Tech

**Rania Smeltz**
Virginia Tech/Biological Sciences

**Antimicrobial copper sometimes kills the agent of Legionnaires' Disease in plumbing, and sometimes does not: A microbiome effect?**

Legionella pneumophila is an opportunistic pathogen (OP) that causes Legionnaires' Disease through the inhalation of contaminated aerosols, i.e., tiny droplets of water suspended in the air. Copper can be released from pipes or added to drinking water plumbing systems as an antimicrobial, but prior research has indicated inconsistent efficacy for controlling Legionella. The objective of this study was to define the levels of copper that are nutrient limiting, optimal, and antimicrobial for L. pneumophila under conditions representative of building plumbing using simulated glass water heaters (SGWHs). SGWHs were equipped with PEX pipe coupons colonized with mature (>3.5-year-old) biofilms. The effect of 5 copper concentrations (0, 4, 30, 250, and 2000 micrograms/L) was tested on total cell counts and L. pneumophila, using both Legiolert™ and droplet digital polymerase chain reaction, in triplicate over a ~1 year period. Consistent trends in total cell counts were generally observed across replicate SGWHs, but L. pneumophila levels appeared random. It is hypothesized that the composition of the drinking water microbiome mediates the effect of copper on Legionella. 16S rRNA gene amplicon sequencing will be applied to identify associations of various microbial species with high versus low numbers of L. pneumophila.

**Mentor(s):** Marc Edwards (Civil & Environmental Engineering), Virginia Tech
Dr. Amy Pruden (Department of Civil & Environmental Engineering), Virginia Tech

**Rebekah Smith**
Virginia Tech/Biology

**The Wonderful World of Eosinophils: Assessing the Role of NIK on Eosinophil Maturation**

The innate immune response is the body's first line of defense. When a microbe enters the body, pathogen associated molecular patterns (PAMPs) are sensed and the innate immune response initiated. These responses activate the canonical pathway or the non-canonical pathway. In the noncanonical pathway, binding of receptors triggers a systematic cascade resulting in the production of NF-kB, a critical protein in the innate immune response. Mice have been used as a model organism to better understand these mechanisms. In previous studies, the elimination of NIK protein, found in the noncanonical pathway, was found to cause over production of eosinophils, an innate immune cell. The migration, proliferation, and maturation of eosinophils is regulated by the signal molecule Interleukin-5 (IL5). IL-5 can be produced by both WBC and non-WBC. It was previously hypothesized that the development of eosinophilia in these mice was directly related to the pathway's effect on T-helper 2 cells, a producer of IL-5. However, when T-helper 2 cells are eliminated from the in vitro environments, eosinophilia persists. We predict that the elimination of Nik not only impacts T- cells but also eosinophil growth and movement without T-helper 2 cells.
To evaluate this hypothesis, I will examine the presence of IL-5 produced by vitro cultured eosinophils lacking Nik and wildtype cells using enzyme-linked immunosorbent assay (ELISA). Through ELISA, I will be able to evaluate the presence of IL-5 produced by an in vivo environment. Next, I will evaluate the maturation of eosinophils at different stages of in vitro culture to evaluate the effects of the presence of IL-5 on development. Based on these, I plan to correlate the effects of IL-5 within the environment on maturation patterns seen in mice lacking Nik.

Based on our hypothesis, we expect to see an increased level of IL-5 resulting in a change in their maturation process due to environmental changes associated with the elimination of Nik.

**Mentor(s):** Irving Allen (Department of Biomedical Sciences and Pathobiology), Virginia Tech

**Analis Smith**
Virginia Tech/Biological Sciences

**F 420 -dependent sulfite reductase gene as selectable marker in sulfite sensitive methanogens**

Sulfite is generally toxic to methanogens due to its inhibitory effects on methanogenesis, the only energy source for these strictly anaerobic archaea. Methanocaldococcus jannaschii, an ancient hyperthermophilic archaeon that inhabits deep sea hydrothermal vents, is not only resistant to sulfite, but can also use it as a sulfur source. This ability is due to a novel F 420 -dependent sulfite reductase (Fsr), encoded by the fsr gene. Most methanogens fsr and therefore could act as selectable marker for genetic analysis in these organisms. To showcase this utility, we have developed constructs that allow the use of fsr as selectable marker and sulfite as selection agent for two mesophilic and sulfite sensitive methanogens, Methanococcus maripaludis and Methanosarcina acetivorans.

**Mentor(s):** Biswarup Mukhopadhyay (Department of Biochemistry), Virginia Tech
Bela Haifa Khairunisa (Department of Biochemistry), Virginia Tech

**Sriya Sridhar**
Blacksburg High School/Advanced Studies

**Utilizing Flow Cytometry to Evaluate the Effectiveness of the Sterilization of a 96 - Well Plate by the Opentrons Liquid Handling Robot**

Each year, biomolecular laboratories generate a combined total of nearly 5.5 million tons of plastic waste. A major source of this single-use plastic waste can be attributed to 96 well plates, which cannot be recycled since they are used to handle hazardous biowastes. The objective of this study is to use an Opentrons Liquid Handling Robot to thoroughly sanitize a 96 well plate, and to determine effective cleaning methods to ensure the least residue. This research consists of two phases: the programming of the Opentrons Liquid Handling Robot to perform a variety of cleaning cycles, followed by flow cytometry to validate the sanitization by measuring Saccharomyces cerevisiae yeast cell count remaining in the wells. A Python protocol was programmed for the Opentrons robot to iterate through columns and rows of the 96 well plate and perform a different cleaning cycle for each of the rows. Wells were sanitized with different cleaning protocols that consisted of varied combinations of a simple rinse using deionized water, bleach, hydrogen peroxide, and either heated or unheated deionized water. The quality of cleaning for each method was tested with flow cytometry. It was established that sanitizing wells containing S. cerevisiae cells with bleach, hydrogen peroxide, and deionized water removed nearly all cells and bleach residue. This was confirmed by flow cytometry, which detected a nearly identical absence of cell or cleaning solution residue counts between unused and sanitized wells.

**Mentor(s):** Clay Wright (Biological Systems Engineering), Virginia Tech
John Bryant (Biological Systems Engineering), Virginia Tech

**Abhiram Srivastava**
Virginia Tech/Geosciences

**Shoshana Chueca**
Virginia Tech/Neuroscience

**Nathan Vinnedge**
Virginia Tech/Neuroscience

**Hanna Scaer**
Virginia Tech/Neuroscience

**Caspian Bailey**
Virginia Tech/Neuroscience

**The Prevalence of ADHD within the Orion LLC**

Attention-deficit hyperactivity disorder (ADHD) is a disorder that often includes attention difficulties, hyperactivity, impulsiveness, and/or inattentiveness. Previous studies have shown a correlation between an ADHD diagnosis and lower academic performance. Therefore, we sought to investigate if the frequency of ADHD in the Orion LLC, a science-oriented living-learning community at Virginia Tech, differs from the national college-age average. In our study, we slightly modified the DSM-5 ADHD diagnostic survey by adding additional questions to assess some demographic data and participant integrity. We recruited participants from the Orion LLC to take our survey. We had 71 participants voluntarily take part in our survey, which was deidentified by our faculty partner before we received the survey results and reduced to 61 usable data points with built-in calibration questions. We found a higher rate of ADHD among members of the Orion LLC (that participated in the survey) than the college age average reported in 2006. Future research could investigate how the different factors uniting members of the Orion LLC independently impact ADHD rates.

**Mentor(s):** Temperance Rowell (COS), Virginia Tech

**Noah Stallard**
Virginia Tech/Human Nutrition, Foods, and Exercise

**Micronutrients as Predictors for Markers of Bone Health in Athletes**

Objective: We conducted a cross-sectional study to identify specific micronutrients that influence bone health in athletes. Methods: Female and male endurance and non-endurance athletes, 18 years of age and older, participated. Body weight (kg), height (m), and body mass index (BMI) (kg/m^2) were assessed. Lean body mass (LBM) (kg), total (TBMD), lumbar (LBMD), and dual femur (FBMD) bone mineral density (BMD) were measured using dual-energy X-ray absorptiometry. Dietary consumption was measured by Food Frequency Questionnaire. We used univariate analysis of variance, Pearson‚Äôs correlation coefficients, and linear regression (age, sex, and LBM as covariates) for statistical analyses. Results: A total of 262 athletes (130 women, 132 men), 35.8¬±11.3 years of age, with a BMI of 24.5¬±3.3 kg/m^2 were included. Zinc intake was positively associated with FBMD (p=0.011) for all athletes. Iron intake was positively associated with FBMD (p=0.036) in all athletes, 18 to 29 years of age, with LBMD (p=0.038) in non-endurance athletes, 18 to 29 years of age, and negatively correlated with LBMD (p=0.024) in non-endurance athletes, 30 to 39 years of age. Phosphorus intake was negatively associated with LBMD (p=0.005) in endurance athletes, 40 years of age and older. Conclusion: Dietary zinc and iron were the two micronutrients most associated with FBMD and LBMD in athletes 18 to 29 and 30 to 39 years of age. Vitamin C and phosphorus intakes were both negatively correlated with LBMD in athletes 40 years of age and older. More prospective research is required to evaluate micronutrient intake and BMD among athletes.

**Mentor(s):** Stella Volpe (Human Nutrition, Foods, and Exercise), Virginia Tech

**Linnea Stripling**
Virginia Tech/Animal and Poultry Science

**Zoe Wachsman**
Virginia Tech/Animal and Poultry Sciences

**Grayson Phillips**
Virginia Tech/Biochemistry

**Jack Horton**
Virginia Tech/Biochemistry

**Jessica Swanson**
Virginia Tech/Animal and Poultry Sciences

**Impact of Organic Fertilizers on Mustard Plant Development and Soil pH**

The products and techniques used to grow commercial crops are important to understand as we look for more sustainable agriculture practices, especially with fertilizers. This raises the question, how are plants affected by changes in the fertilizer used to grow them? Our group investigated this question by planting 16 mustard plants that we sectioned into 4 different experimental groups (n=4 pots/treatment). Our 3 fertilizer groups were urea, worm castings, and chicken manure with a 4th group as the no fertilizer control. Since we used seeds to grow our mustard plants, we performed 2 different experiments. The first experiment was adding our fertilizer treatments to the soil after our seeds had germinated. The second experiment was adding our fertilizer treatments to the soil upon planting our mustard seeds. This enabled us to understand what effects our fertilizers had before and after germination in addition to potential effects on plant growth over time. Plants were kept in a greenhouse, received 12h:12h (light/dark), were watered weekly, and growth measurements and observations were recorded weekly. Overall, urea seemed to negatively affect plants in both experiments, while our plants preferred worm castings followed by chicken manure fertilizer treatments. Future research could be used to better understand the effects of growth by sustainable manure sources like worm castings and chicken manure on mustard plants and other food-based plants.

**Mentor(s):** Temperance Rowell (College of Science), Virginia Tech

**Rebecca Sturniolo**
Virginia Tech/Biochemistry

**Luna Leppiani**
Virginia Tech/Biochemistry

**Lana O'Flynn**
Virginia Tech/Biochemistry

**Molly Porter**
Virginia Tech/Biochemistry

**Sierra Reagan**
Virginia Tech/Biochemistry

**Utilization of Computational Data to Compare the Binding Affinity of Morphinan versus Fentynal in the μ-Opioid Receptor (μOR) of Mus Musculus**

The μ-opioid receptor is a protein that is responsible for regulating pain responses within the nervous system. Opioids are highly addictive, leading to an epidemic of deaths by overdose with newer and more potent opioids causing thousands of overdoses each year. If the agonist fentanyl is bound to the μ-opioid receptor, then it will bind more strongly than the morphinan antagonist. This is because fentanyl has a greater binding affinity because it is more lipophilic, which allows it to bind better than other ligands. The μ-opioid receptor with the morphinan and fentanyl ligand structure was viewed in PY-MOL. Next, the fit of each ligand was tested with molecular docking. This found that the morphinan ligand had a binding affinity of -9 kcal/mol and the fentanyl ligand had a binding affinity of -8.7 kcal/mol. This showed that the morphinan had a better binding affinity and fit better in the binding pocket. In the future, the experiment could be completed with different binding pocket dimensions in Webina to see if fentanyl ever has a greater binding affinity than morphinan. Opioids work to reduce pain symptoms by binding to the μ-opioid receptor, triggering an analgesic (pain-relieving) pathway response.

**Mentor(s):** Anne Brown (Biochemistry), Virginia Tech

**Rhianna Sullivan**
Virginia Tech/Cognitive and Behavioral Neuroscience

**The Role of Mindfulness as a Mechanism for Improving Self-Compassion and Reducing Anhedonia**

Mindfulness based stress reduction (MBSR) is a meditation-based intervention that has been shown to have positive effects on mental and physical health. Previous studies have separately shown MBSR to decrease anhedonia and increase self compassion. However, it is unclear whether self-compassion and anhedonia are significantly related, and if so, whether mindfulness moderates this association. Accordingly, the purpose of the present study was to examine the mechanistic status of mindfulness as it relates to self compassion and anhedonia in a randomized controlled trial (RCT). We hypothesized that changes in self-compassion and changes in anhedonia in the context of 8-weeks of MBSR would be significantly correlated and that change in mindfulness would moderate the relation between them. Fifty eight adults (age 18-55) who experience chronic stress volunteered to participate in an 8-week RCT of MBSR. Participants were randomly assigned to either an 8-week MBSR intervention or a wait-list control group. The Dimensional Anhedonia Scale (DARS), Self Compassion Scale (SCS), and Five Facet Mindfulness Questionnaire (FFMQ) self-report questionnaires were used to evaluate anhedonia, self compassion, and mindfulness respectively. Consistent with predictions, correlational analyses indicated that there was a significant correlation between changes in self compassion and changes in anhedonia, such that as self compassion increases, anhedonia decreases ($r = .36$, $p < 0.01$). Regarding moderational analyses, results indicated that the interaction between mindfulness in the relation among anhedonia and self-compassion was statistically significant ($\beta = 0.003$, $p < 0.05$, LLCI=0.0008, ULCI =.0043). These results suggest that mindfulness influences the relationship between self-compassion and anhedonia, and further highlights mindfulness as a mechanism of change to potentially reduce anhedonia and improve well-being.

**Mentor(s):** John Richey (Psychology), Virginia Tech

**Tessa Thibodeau**
Virginia Tech/Biological Sciences

**Allison Montgomery**
Virginia Tech/Ecological Restoration

**Piyali Roy**
Virginia Tech/Biological Sciences

**Kathryn Ouimet**
Virginia Tech/Biological Sciences

**Sean Horner**
Virginia Tech/Biological Sciences
**Isabella G. Iscaro**
Virginia Tech/Biological Sciences
**Madison L. Ruschaupt**
Virginia Tech/Biological Sciences

**Greenwashing: Are Consumers Being Mislead About the Benefits of "Green" Consumer Products?**

Eco-friendly or “Green” consumer products are advertised as less toxic and more degradable than traditionally available products. These labels can be misleading, as these products lack regulation and testing to determine their fate within the environment and on non-target organisms. The use of these products results in them entering wastewater treatment facilities where they are not removed completely, entering the environment at varying rates without regulation. Previous assessments 10 years ago demonstrated that green products were typically equal or more toxic to sensitive aquatic organisms before and after degradation. In our assessment, we are investigating whether those products (not reformulated) are indeed less toxic and degradable. For this, we have exposed juvenile Daphnia magna to 4 different product categories ( dish detergent, fabric softener, laundry detergent, and all-purpose cleaner) that include one green labeled product and two conventional counterparts for a 48hr acute toxicity assay at levels below what you would find in the environment. After completing the, we statistically analyzed the median lethal concentrations to kill 50% of the population (LC50) and compared the green-labeled product to its conventional counterpart using an LC50 ratio test.
Our findings demonstrate that for non-degraded products, the green products were equal or more toxic in three of the four product categories. For the degraded, we have seen that the green product is less toxic or 50% of the products. Our findings highlight that product reformulation has helped reduce hazards, however. This is specific for only degraded products. Emphasizing to the consumer, caveat emptor.

**Mentor(s):** Austin Gray (Biological Sciences), Virginia Tech

**Stephen Trampe**
Virginia Tech/Biochemistry

**Maddie Ferguson**
Virginia Tech/Biochemistry

**Characteristics of iron-sulfur clusters assembled by Thioredoxin 2 from Methanocoldococcus jannaschii**

Thioredoxin, a small acidic protein, is present in most organisms. It catalyzes the reduction of cysteine residues to control protein function, including their roles in cellular oxidative stress management. Methanocoldococcus jannaschii (Mj), a strictly anaerobic, hyperthermophilic, chemolithotrophic, methanogenic archaeon that lives in deep-sea hydrothermal vents, carries a novel thioredoxin, MjTrx2. It shows poor cysteine disulfide reduction and it seems to assemble an iron-sulfur cluster. Additional data from our laboratory indicates that it is a redox sensor. During aerobic purification of a His6-tag version from a recombinant E. coli, it formed a brown band in the nickel affinity column. The color was unstable. We hypothesize that the iron-sulfur cluster is oxygen sensitive or the nickel NTA removes it. To test this hypothesis, we designed two protein expression vectors. One with a T7/ lac promoter for aerobic expression and the other with narG promoter for anaerobic expression. Both generate the protein with a strep-tag. Production of the protein aerobically using the first vector, and employing Strep-tactin chromatography showed that the iron-sulfur cluster is oxygen-sensitive. The work with the second vector is in progress. It will help to obtain the protein under strict anaerobic conditions, and to determine if it carries iron-sulfur clusters.

**Mentor(s):** Biswarup Mukhopadhyay (Biochemistry), Virginia Tech
Christian Heryakusuma (GBCB), Virginia Tech

**Carmen Tran**
Virginia Tech/Cognitive and Behavioural Neuroscience

**Victoria Lee**
Virginia Tech/Clinical Neuroscience

**Rowan Jennings**
Virginia Tech/Psychology

**Social Media Implications in the Perpetuation of Misogynistic Culture**

This study will aim to explore how misogynistic content on social media is perceived by men and women, ultimately seeking possible gender differences. To investigate this issue, the study will consist of 150 undergraduate psychology students (75 men, 75 women), ranging from 18 to 25 years old, who attend Virginia Polytechnic Institute and State University. The participants will be shown misogynistic and non-misogynistic social media content, ranking each video on a scale of 1 (non-misogynistic) to 7 (the most misogynistic). Statistical analysis will be completed to analyze the participants' rankings via an independent t-test. It is expected that when exposed to misogynistic social media content, women will not only recognize more incidences of misogyny but also perceive the content as more intensely misogynistic than men.

**Mentor(s):** E. Scott Geller (Psychology), Virginia Tech,
Jack Wardale (Psychology), Virginia Tech

**Eric Truong**
Virginia Tech/Biochemistry

**Does Regular Sound Change in French Contribute to Analogical Leveling in the French Present Active Indicative Tense?**

French is a romance language that has stemmed from Vulgar Latin, and throughout the centuries, French had undergone characteristic sound changes that gave rise to modern French. Verbs in the French present active indicative tense have undergone many morphological and phonological changes since the Latin version of that verb. Particularly, the first, second, and third person conjugations in the present active indicative tense have undergone major regularization and analogical leveling. These forms have been reduced to near identical forms, however, in spoken French, the first, second, and third person are all pronounced the same, without any indication of subject-verb agreement, thus there are residual letters that only exist in writing. This study examines how the conjugation endings from classical Latin have changed to modern French conjugation endings, and whether the phonological sound changes inherent to the French language have contributed to these losses in distinction. In addition to the regularization and leveling in these verb forms, word-order dependency may have evolved alongside this change. Methods include selecting verbs that have similar stems in both Classical Latin and modern French, and applying known phonological changes in French to the selected verbs. Anticipated results include mapping out the various phonological rules to these verbs and hopefully providing evidence that these normal sound changes have contributed to analogical leveling in the first, second, and third person singular present active indicative tense in modern French.

**Mentor(s):** Abby Walker (Department of English), Virginia Tech

**Alina Tseng**
Virginia Tech/Human Development

**Sebastian Ballesteros**
Virginia Tech/Psychology

**Margaret Ashley**
Virginia Tech/Human Development

**Angel Appiadu-Manu**
Virginia Tech/Biochemistry

**Zainab Shamim**
Virginia Tech/English Literature

**Are you still watching on your phone or TV? The impact of mobile media on visual attention and learning**

Mobile devices are ubiquitous in our daily lives. Will technology-mediated learning become more effective through the use of mobile media devices? Using desk-mounted eye-tracking systems, researchers revealed that adults systematically deploy visual attention during video viewing. Adults' attention is primarily captured by relevant features, which could contribute to comprehension (Franchak et al., 2015; Kirkorian & Anderson, 2018). However, few studies to date have investigated how adults pay attention to and learn from mobile media content. Using a head-mounted eye-tracking system, this project examined how adults pay attention and learn from portable and non-portable media devices. College students (N = 24) between the ages of 18 and 25 years completed a one-hour lab session consisting of computerized cognitive tasks, surveys, and eye-tracking sessions while watching videos. Participants wore eye-tracking glasses and watched videos displayed on a tablet through two conditions: either by holding the tablet (portable) or leaving the tablet on a stand (fixed). If holding the device is beneficial for learning, we would expect better attention to, and comprehension of, videos in the portable condition compared to the fixed condition. If holding the device is detrimental for learning, we would expect the reversed pattern. Data analysis is in progress. This research has implications for understanding how viewers can effectively use digital devices for learning.

**Mentor(s):** Koeun Choi (Human Development and Family Science), Virginia Tech

**LeeAnne Tunstall**
Virginia Tech/Psychology

**Samantha Kaps**
Virginia Tech/Psychology

**Jacob Holloway**
Virginia Tech/Psychology

**A mediation model examining the association between sexual assault experiences(SES) and alcohol use problem (AUDIT) mediated by anger (BPAQ-Anger subscale).**

Sexual assault (SA) is prevalent among college students and is associated with alcohol use problems (AUP). Those with sexual trauma experience continual anger or anger management problems, which also contributes to AUP (Ageton, 1983; Beck & Heinz, 2013; Thomas et al., 2012). It follows that anger may explain the association between SA victimization and AUP among undergraduates. This study tested the hypothesis that undergraduates,Äô SA victimization would positively associate with their AUP directly and indirectly through anger.

Undergraduates (N=236, 67.4% women, Mage=20.5) completed a cross-sectional self-report survey on AUP (Alcohol Use Disorders Identification Test), SA victimization (Sexual Experiences Survey subscales), and anger (Buss Perry Aggression Questionnaire Anger subscale).

We tested for significance of the indirect effect (i.e., that SA victimization would positively relate to AUP indirectly through anger) for five models of SA victimization (frequency of rape, attempted rape, coercion, attempted coercion, and sexual contact) using 5,000 bootstrapped samples and bias-corrected 95% confidence intervals. Each SA victimization type was examined as a separate outcome. Although rape (β=.77, p=.01), attempted rape (β=.68, p=.01), and sexual contact (β=.67, p=.01) positively related to AUP, there was no significant indirect effect of anger across models.

Anger did not account for SA victimization and AUP associations, and not all SA victimization types related to AUP. Other experiences (e.g., difficulty coping, posttraumatic stress symptoms) should be investigated as mediators of the SA victimization-AUP link using longitudinal designs.

**Mentor(s):** Meagan Brem (Psychology), Virginia Tech
Allison Tobar-Santamaria (Psychology), Virginia Tech

**Melanie Turner**
Virginia Tech/Biology

**La Crosse vector competency of container-breeding mosquitoes contrasting different viral strains and two environmental temperatures**

Mosquitos are a key contributor to the transmission of many different types of vector-borne pathogens. In the United States, La Crosse virus (LACV) is the leading cause of pediatric arboviral encephalitis, primarily causing infections in children. LACV is primarily vectored by a native mosquito, Aedes triseriatus, in an enzootic cycle with Sciuridae vertebrate hosts, but has also been isolated in Aedes albopictus, an invasive species that has been implicated as a potential vector. Initial experiments in our lab showed that LACV can infect, disseminate, and would transmit through saliva of Ae. albopictus. Here, we contrast LACV vector competency for Ae. albopictus at two different holding temperatures to simulate transmission rates between summer and fall, and in the face of climate change. Groups of adult mosquitoes were exposed to one of four different strains of LACV-infected blood (NC97, TX09, 1864, NY05) via an infectious blood-meal. Mosquitoes were then incubated at either 26ºC or 29ºC, with 80% RH and 15:9 LD photoperiod. Two weeks (14 days) post-exposure, their legs, bodies, and saliva were harvested and screened, via cell culture, to indicate infection, dissemination, and ability to transmit, respectively. Final results are expected by the end of semester. In summary, we evaluate the implications of both viral strain and temperature on LACV vector competency of Ae. albopictus. With invasive mosquito species expanding to new regions as a result of climate change, there may be an altered risk of disease dynamics of mosquito borne pathogens.

**Mentor(s):** Gillian Eastwood (Department of Entomology), Virginia Tech
Lindsey Faw (Department of Entomology), Virginia Tech

**Charlotte Tury**
Virginia Tech/Biological Sciences

**Assessing Spatial and Temporal Activity of Native and Invasive Amphibians through Bioacoustic Remote Sensing Technology**

Passive acoustic monitoring is a useful remote sensing tool for detecting fine-scale temporal activity of calling animals. These data can also be used to build and parameterize species distribution models. In this study, bioacoustic data recorded in southeastern Arizona during the summer and fall of 2021 is being analyzed for two target species: the invasive American bullfrog (Lithobates catesbeainus) and the threatened native Arizona treefrog (Hyla wrightorum). The goal is to uncover information about the location and activity patterns of these two species for broader conservation and management purposes. The study aims to discover if these target species are restricted to a certain elevation range. Acoustic data are being analyzed using Wildlife Acoustics's Kaleidoscope Pro software. Manual datasets are being made by scanning through acoustic data files and also using the software's built-in tool that groups similar calls across multiple files. To determine the focal species' elevation dispersion, the ranges of bullfrog and Arizona treefrog presence were compared. The study is still ongoing, and preliminary results show that both species have occurred at one site so far during the summer of 2021. Furthermore, preliminary data show that the American Bullfrog was found at elevations ranging from 1,544 to 1,732 m, but this may change as analysis is ongoing. The acoustic data, as well as ongoing 2022 data collection, will be used to answer questions on how conservation efforts might be improved by adding fine-scale temporal and spatial occupancy of the invasive bullfrog and identifying overlap with the threatened Arizona treefrog.

**Mentor(s):** Meryl Mims (Department of Biological Sciences), Virginia Tech
Grace O'Malley (Department of Biological Sciences), Virginia Tech

**Charlotte Tury**
Virginia Tech/Biological Sciences

**Male song sparrow (Melospiza melodia) territoriality and aggression during the non-breeding season**

Song sparrows (Melospiza melodia) are highly aggressive songbirds that live in urban and rural habitats. Many studies have shown that urban song sparrows are more aggressive and territorial during the breeding season compared to rural ones, but these behaviors have been less explored during the non- and pre-breeding seasons. This study seeks to further our understanding of territorial presence in song sparrow populations throughout the non-breeding season, and assess the magnitude of territorial aggression during the pre-breeding season. To investigate territorial presence, we created transects at two study sites,Äìone rural and one urban,Äìthat have previously been used by the Sewall lab for song sparrow research in Blacksburg, VA. We sampled each transect once a month from October 2022 to February 2023 to determine male presence/absence. The magnitude of territorial aggression was assessed through performing simulated territory intrusions on 30 males (15 urban, 15 rural) in March 2023. We predicted that urban male song sparrows would exhibit greater territoriality than rural males, demonstrated through higher presence at territories during the non-breeding season and stronger aggressive responses to simulated territory intrusions during the pre-breeding season. Contrary to this prediction, rural songbirds were found on territories more often than their urban counterparts. Further study is required to determine how the surrounding biotic and abiotic factors may be contributing to these differences. By studying male song sparrow territoriality and aggression outside of their breeding season, we are better able to inform previously held assumptions on how they behave during a lesser-studied time of year.

**Mentor(s):** Kendra Sewall (Department of Biological Sciences), Virginia Tech
Isaac VanDiest (Department of Biological Sciences), Virginia Tech
Taylor Fossett (Department of Biological Sciences), Virginia Tech
Samuel Lane (Department of Biological Sciences), Virginia Tech

**Hannah Upson**
Virginia Tech/Political Science

**Dehumanization and Reporting: The Denial of Native Women's Reproductive Rights**

Over the years 1973 to 1976, 3,406 native women were sterilized in four federally-funded Indian Health Service facilities. This study examines the 1976 Government Accountability Office investigative report into these IHS facilities. The final report of this investigation excludes native women's testimony and versions of the events. I argue that this exclusion exemplifies the power dynamics at play in both the IHS facilities and investigation, as well as the persistent eugenical thought in policy and investigation. I contextualize this program as part of a larger trend: in the 1970s where policies presented a facade of "family planning," while the U.S. government promoted eugenics, especially of indigenous, black, and disabled women. This analysis is based on primary sources, the GAO report and a collection of patient testimony.

As debate over women's reproductive rights continues in the U.S., it is important to recognize that marginalized women's reproductive rights have often been left out of these conversations. Through a close reading of the GAO report, I show the blant exclusion of native women's voices from these conversations. I draw from the film Ama, which recorded patients' experiences of the impacts of sterilization without consent. This paper uses disability justice as a framework in centralizing marginalized voices in order to document an accurate historical account of an event that has appeared historically one-sided. Marginalized people are the experts of their own lived experience, and disability justice demands that we hear the voices of people who are being silenced and privilege those most marginalized in our communities. This paper establishes evidence of oppression and the enduring need for disability justice.

**Mentor(s):** Monique Dufour (History), Virginia Tech

**Abigail Valle**
Virginia Tech/Biological Sciences, biomedical option

**Rhianna Sullivan**
Virginia Tech/Cognitive and Behavioral Neuroscience

**Correlative Carbohydrate Reward**

While there is increasing interest in the physiological and neurological effects of processed food, there is a lack of knowledge on how the various chemical structures of carbohydrates impact their metabolism and therefore how they are signaled to the brain. Here, we test three different carbohydrates that are thought to be slowly metabolized by the body. In this three-week study, metabolically healthy participants, aged 18-45 years, are exposed to 3 beverages, 2 times each. Each beverage contains a novel flavor and calories in the form of either long-chain maltodextrin (long_malto), long-chain maltodextrin plus fiber (fiber_3g), or a mixture of amylopectin (branched glucose molecules) and long maltodextrin (60m/40a). Each beverage is consumed 2 times with 2 in-lab testing sessions. In one session, blood is drawn in order to measure blood glucose over the course of one hour post-consumption. In another, we perform indirect calorimetry with a metabolic cart to assess post-consumption changes in metabolism and substrate oxidation rates pre and post-consumption. We hypothesize that the long_malto will be metabolized most quickly, followed by fiber_3g, and finally 60m/40a. The results of this study will provide a greater understanding of how different carbohydrates are metabolized by the body, as well as provide a basis for our current study which evaluates the impact of carbohydrate metabolism on physiology and reward using fMRI technology.

**Mentor(s):** Alex DiFeliceantonio (Neuroscience), Virginia Tech

**Anirudh Venkanagari**
Virginia Tech/Clinical Neuroscience

**Going With The Flow: Interactions of interstitial fluid flow from the brain to the lymph node in cancer**

Interstitial fluid flow (IFF) has been shown to play a key role in assisting the invasiveness of cancer cells in nearly all forms of cancer. The increased interstitial pressure from tumor masses leads to increased fluid flow which leads to an increase in tumor cells propagating, resisting, and sometimes avoiding treatment altogether. Thus studying and characterizing the role of interstitial fluid flow is vital in understanding how to best treat it. Our work focused on how glioblastoma cells interacted at different sites along fluid flow pathways: from the brain to the meningeal lymphatics and ultimately, draining into lymph nodes. We examined patient-derived glioma stem cells in a 3D tissue engineered in vitro transwell model that recapitulated the brain microenvironment in pathological flow conditions in the brain in our in vitro studies . In an orthotopic mouse model, we then observed lymph nodes as an endpoint measure of the tumor cells to assess remodeling and impact they had on the microenvironment within the lymph node. Our in vitro results have suggested that in conditions mimicking increased interstitial flow, there is an increase in invasion of glioma stem cells. From our in vivo work, we show that there are changes to the lymph node microenvironment in tumor-bearing mice. Ultimately, our results from this study can be used to better understand key mechanisms and populations involved in cancer progression.

**Mentor(s):** Monet Roberts (Department of Biomedical Engineering and Mechanics), Virginia Tech

**Anirudh Venkanagari**
Virginia Tech/Clinical Neuroscience

**Going With The Flow: Interactions of Interstitial Fluid Flow from the Brain to the Lymph Node in Cancer**

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**Mentor(s):**
Monet Roberts (Department of Biomedical Engineering and Mechanics) Virginia Tech
Yamilet Macias-Orihuela (Department of Biomedical Engineering and Mechanics), Virginia Tech
Cora Esparza (Department of Biomedical Engineering and Mechanics), Virginia Tech
Jennifer Munson (Department of Biomedical Engineering and Mechanics), Virginia Tech

**Andrew Wang**
Blacksburg High School/Advanced Studies

**Effects of Transcription Factor WUSCHEL on the Regeneration of Arabidopsis thaliana**

As the global population and the food demand increase, regeneration of modified crops with increased crop production or enhanced resistance to various stresses became a promising approach. Plant regeneration is a critical step in producing GMOs (Genetically modified organisms). However, many crop species or current varieties in a crop are recalcitrant to regeneration. This study, using a model organism Arabidopsis thaliana, intends to test the effects of a transcription factor WUSCHEL in plant regeneration. Transgenic Arabidopsis plants with the expression of WUS controlled by an Estradiol-inducible promoter were used. The Arabidopsis seeds were grown on medium with or without Estradiol. The number of shoots formed in an SIM (Shoot Induction Medium) along with the growth and characteristics of the calli and plantlets were also examined. Student t-test was used to determine whether a statistically significant difference exists between the number of shoots formed in the absence or presence of Estradiol. Arabidopsis plantlets expressing WUS were observed to form larger and smoother calli and formed more and larger shoots but less and smaller roots than those not expressing WUS. The results indicated that the expression of WUS increases plant regeneration and can be employed for other crops.

**Mentor(s):** Bastiaan Bargmann (College of Agriculture and Life Sciences), Virginia Tech
Kelsey Reed (College of Agriculture and Life Sciences), Virginia Tech

**Tessa Wannenburgh**
Virginia Tech/Agricultural Technology

**Rachel Mohler**
Virginia Tech/Agricultural Technology

**Seasonal Forage Yield and Nutritive Value Responses to Nitrogen Fertilization Rates in Stockpiled Tall Fescue**

Our research is to compare and determine the seasonal forage yield and nutritive value responses to nitrogen fertilization rates in stockpiled tall fescue. We hope to determine whether fertilized stockpiled tall fescue will have a positive yield and quality response compared to unfertilized stockpiled tall fescue. Those managing pasture systems are economically challenged by higher fertilizer costs and lower profit margins. We would like to determine if it is economically beneficial for producers to fertilize their stockpiled tall fescue. Our experiment is a randomized, four by four, plot design. Each plot is 10'x15', the total research area is 40'x60'. We randomly assigned each plot a fertilizer rate of 0, 40, 80, or 120 lbs. of nitrogen. For five months, beginning November 2022 and ending March 2023, we randomly collected a forage sample measuring a quarter meter squared located within each replication. These samples were then dried, weighed, and analyzed for nutritive value. We believe that there will be a positive yield response correlated to increased nitrogen application. We do not believe there will be a significant nutrition response to nitrogen application compared to that of unfertilized.

**Mentor(s):** Wesley Gwaltney (Agricultural Technology), Virginia Tech
Gabriel Pent (School of Plant and Environmental Sciences), Virginia Tech

**Evelyn Washburn**
Virginia Tech/Mechanical Engineering

**Modeling the Influence of Turgor Pressure on Cellular Adhesion**

Cells attach to and sense their environment by forming adhesive patches that are mediated by specific adhesions. Bacterial and fungal cells leverage adhesion to attach to surfaces and eventually form biofilms allowing them to survive for long periods of time. The biofilms allow the microbial colonies to grow and thrive on biomedical devices contributing to loss of life from hospital-acquired infections. The attachment process is driven by adhesion energy and the mechanical properties of the cell. Experimental characterization has revealed the importance of cell mechanics in the adhesion process, however the roles of turgor pressure, cell stiffness, work of adhesion, and external forces on the cell attachment process remain unclear. To address this gap, we developed a theoretical model to capture the adhesion process of a spherical pressurized elastic membrane. We found that as turgor pressure increases, the area of the cell in contact with the surface decreases. For weak adhesion, we recovered power law scaling between the contact size and work of adhesion. We also examined the effect of external forces on the adhered cell to capture the force separation response. The model provides a framework to characterize the mechanical properties of cells by observing the adhered geometries. The knowledge gained here and extensions of this work can be leveraged to design biomedical surfaces that can mitigate the initial attachment of pathogens.

**Mentor(s):** Sohan Kale (Mechanical Engineering), Virginia Tech

**Jennie Weitzenhofer**
Virginia Tech/Wildlife Conservation

**Assessing American Black Bear (Ursus americanus) Proximity to Human Settlements via Video Camera Collars in Rural Bath County, VA**

Little is known about the day-to-day life of wild American black bears (Ursus americanus). Understanding black bear behavior patterns and space use can lead to more effective wildlife management plans. However, it is challenging to study the natural behaviors of wild bears, as they are an elusive species. Thus, little work has been done to systematically assess the behavioral time allocation of wild black bears. One aspect of better understanding wildlife behavior is looking at the potential for human-wildlife interactions on the landscape. We have a unique data set of collar cameras on 15 wild bears (7F, 8M), tracking their movements for 1 to 6 months in 2018 and 2019. Each bear‚Äôs camera collar recorded 10 to 20 seconds of video every 20 to 60 minutes during daylight hours from June to December. Each video is paired with a global positioning system (GPS) location that we used to determine the distance to the closest human settlements in the area, which could include office buildings, houses, or barns. We then compared that distance to observed black bear activities to isolate if they exhibit certain behavior types, such as foraging, closer to human settlements. Our preliminary results show a sex-mediated trend, where females forage closer to human settlements than males do. As we finish conducting our analysis, we are interested in this topic in order to further understand what proximity to development bears are foraging and if they prefer specific habitats over others. This information is important to the Virginia Department of Wildlife Resources because it provides a better understanding of daily black bear behavior in the wild, which is relevant to potential human-bear interactions.

**Mentor(s):** Marcella Kelly (CNRE), Virginia Tech

**Elizabeth White**
Virginia Tech/Psychology

**Chase Caverly**
Virginia Tech/Psychology

**Annabelle Williams**
Virginia Tech/Psychology

**The Effects of Stress on the Accuracy of Emotional Perception**

The perception of facial expressions are crucial to everyday life and stressors are inevitable. Whether a doctor is trying to assess the wellbeing of a patient, a teacher is trying to gauge their students' understanding of class material, or a police officer is attempting to de-escalate a situation, correctly interpreting the emotions of another can one to better grasp a social situation. Overall, accurately predicting the emotions of others is an important skill.

Present Study: All participants will be assigned to complete an emotional perception task while being exposed to certain stressors. This will be a 50 question test, flashing a microexpression of various emotions derived from Paul Ekman's research on universal facial expressions. Participants will have an option to select one of seven emotions that correlate with the face shown. Participants are randomly assigned to one of four conditions: control group, time constraint, authority, or time constraint/authority. After completing the test, participants will complete a Big5 Personality test in order to see if there is any correlation between personality traits and emotional perception.

Increasing amounts of stress are predicted to show an inverse relationship with emotional identification. Therefore, we predict that the time constraint/authority condition will show the lowest score on the emotional identification test. On the other hand, the control group will score the highest on the emotional identification test. Preliminary control group results show participants were able to correctly identify the emotions being shown 90% of the time. Data collection is in progress.

**Mentor(s):** Scott Geller (Psychology), Virginia Tech
Jack Wardale (PhD candidate in the Psychology), Virginia Tech

**Kylie Wijeratne**
Virginia Tech/Psychology

**Evaluating the Short Sensory Profile 2 with Children and Adolescents with ASD, Anxiety, and/or ADHD**

Sensory difficulties are common among children and adolescents with autism spectrum disorder (ASD). Sensory over-responsivity (SOR) and sensory under-responsivity (SUR) both fall under the restricted, repetitive patterns of behaviors, interests, or activities symptom cluster of ASD. As ASD is commonly comorbid with attention-deficit/hyperactivity disorder (ADHD) and anxiety, which are also characterized by sensory difficulties, it is important to assess the possible impacts of comorbid conditions on sensory dysfunction. As such, this study sought to examine whether youth with ASD display more SUR and SOR relative to youth who exhibit anxiety and/or ADHD only or comorbid with ASD, and examine if biological sex or age predicts SUR and SOR. Participants included 44 youth (28 male) ages 2-15 years old. Parents completed the Short Sensory Profile 2 which provides scores in four sensory quadrants with the sensory seeking and sensory avoidance quadrants representing SOR and the bystander/registration quadrant categorizing SUR. Results showed that autistic youth with comorbid ADHD and/or anxiety did not differ from individuals with ASD alone on severity of SUR and SOR. However, they were higher than individuals with anxiety only for sensory seeking and bystander/registration and for individuals with ADHD and/or anxiety only for sensory avoidant. Sensory dysfunction was present across child developmental periods (i.e., did not differ for children vs. adolescents). Males were more likely to exhibit SUR and SOR than females. These findings highlight the importance of working with occupational therapists to address sensory dysfunction, particularly among autistic youth.

**Mentor(s):** Rosanna Breaux (Psychology), Virginia Tech

**Mackenzie Woolls**
Virginia Tech/Public Health

**NLRX1 Modulation of Sars-CoV-2 Immune Response**

Since the beginning of the Covid-19 pandemic, there have been 6.6 million deaths attributed to the disease. Severe progression of Covid-19 is attributed to the cytokine storm initiated by the immune response to the virus. NLRX1 is a NOD-like pattern recognition receptor, active in innate immune pathways. NLRX1 is part of the NF-$\kappa$B pathway, which regulates cytokines such as IL-6 and TNF-$\alpha$. We hypothesize that when NLRX1 is present, it will help moderate the immune response to Covid-19 and decrease damage done to the body. When NLRX1 is knocked out, we believe we will see a more extensive immune response and therefore more damage. Post challenge with Sars-CoV-2 virus (MOI of 1), in primary mouse bone marrow derived macrophages, have shown that lack of NLRX1 significantly increases IL-6 levels. IL-6 is a pro-inflammatory cytokine. Macrophages challenged internally with nucleocapsid proteins of Sars-CoV-2 had an increase of IL-6 in Nlrx1-/- macrophages. However when challenged with nucleocapsid proteins externally, wildtype macrophages had significant levels of IL-6. Previous studies have found that increased IL-6 levels are present in patients experiencing severe Covid. Histology slides have shown a significant difference in inflammation of the lungs when infected, with Nlrx1-/- mice experiencing more inflammation. Immunohistochemistry shows a larger amount of viral cells in knockout mice compared to wildtype mice. There are very limited therapeutic options for Covid-19. The suggestive data on NLRX1 warrants further research into the potential therapeutic drug target.

**Mentor(s):** Irving Allen (Veterinary Medicine and Biomedical Sciences), Virginia Tech

**Neeharika Yallayi**
Virginia Tech/Biology

**Stress Hormone Selectively Reactivate Herpes Simplex Viruses in Sensory and Autonomic Neurons**

The goal of this project is to determine which part of the herpes simplex virus latency associated transcript (LAT) gene is responsive to the stress hormone epinephrine. Herpes simplex virus (HSV) is a virus that can affect the oral and genital areas of the body, causing skin lesions and in some cases, more serious complications. If one is infected, HSV stays latent or dormant in neurons that innervate the area of infection for the rest of their life. There are various factors that can influence the virus to be reactivated in the neurons and start replicating again, causing recurrent disease. Stress is a common factor that causes reactivation. HSV has a viral gene called the latency associated transcript (LAT), which is involved in stress-induced reactivation, although the specific mechanism of how this gene responds to stress is unknown. However, a previous study showed that HSV does not reactivate if the LAT gene is deleted. Currently, many antivirals reduce the frequency of HSV, but do not prevent it. Identifying how the stress hormone epinephrine works with LAT to cause HSV to reactivate can allow for the development of antivirals that are more effective and prevent reactivation, which would eliminate the transmission to others. During this project, I will be generating neuronal cultures from adult mice and infecting them with HSV 1 or HSV 2 viruses which have mutations in the LAT gene. I will then add acyclovir, which prevents the virus from replicating to achieve latency in the neurons. After 7 days, I will remove the acyclovir, and then add epinephrine, which causes the normal wild type virus to reactivate. 24 hrs later, I will extract the DNA from the infected neurons and perform qPCR to produce quantitative results for the viral genome. I will learn how to analyze and perform statistical tests to compare the qPCR results. Comparing these results will determine if the mutant viruses reactivate similarly to the normal virus. Mutant viruses that do not reactivate have a deletion in the part of the LAT gene that responds to epinephrine. I will also learn how to use antibodies for the virus and neuronal markers for identification of the neurons that reactivated.

**Mentor(s):** Andrea Bertke (Population Health Science), Virginia Tech

**Shreya Yedla**
Virginia Tech/Biomedical Engineering

**Gas-Chromatography Mass-Spectrometry-based Plasma Metabolomic Analysis of Type 2 Diabetes in Mice**

Metabolomics is a rapidly evolving tool to study small molecules (molecular weight <1000Da) that define the metabolic status of a biological system. It has been applied extensively to discover biomarkers for various human diseases, including cancer, Alzheimer‚Äôs disease, and heart failure, for a better understanding of pathophysiology and early diagnosis. Gas chromatography coupled to mass spectrometry (GC-MS) has been used as a complementary approach to liquid chromatography mass-spectrometry (LC-MS) to increase the metabolome coverage. For example, GC-MS has enabled the detection of compounds such as intermediates of Krebs cycle and glycolysis pathways, which have been reported to be consistently altered in cancer and cardiac metabolism. It has been proposed that early diagnosis of diabetes via biomarkers may prevent the onset of complications, thereby extending the healthy life span of the patient. The current biomarkers of diabetes include glycated hemoglobin (HbA1c) and glycated albumin. However, due to moderate sensitivity and specificity, those biomarkers are inaccurate in certain clinical conditions. Therefore, identification of additional biomarkers might help to identify individuals at high risk for developing prediabetes and subsequent progression to diabetes. In this study, I used a high sensitive triple-quadrupole GC-MS system to analyze plasma samples from ob/ob mice, a genetically modified mouse model of type 2 diabetes. Metabolomic profiling identified 16 metabolites associated with obesity and diabetes. In addition to the known metabolic signatures of diabetes (i.e., sorbitol, 3-hydroxybutyrate, stearic acid), we found that the levels of glycerol, glycerol 3-phosphate, citrate, malate, galacturonic acid, phenylalanine, glutamine, urea, uric acid were significantly increased in ob/ob plasma samples as compared with WT mice. These data show that our GCMS analysis successfully detected known biomarkers in diabetes and further suggest that it may allow to identify novel metabolic signatures of diabetes using a GCMS system.

**Mentor(s):** Junco Warren (Human Nutrition, Foods, and Exercise, College of Agriculture and Life Sciences), Virginia Tech

**Ela Yirmibesoglu**
Virginia Tech/Biology

**Jaguar injury rates**

Apex predators, like jaguars (Panthera onca), play important roles in ecosystems by regulating prey populations. Individual jaguars can be subject to injuries that may compromise their long-term fitness (i.e. survival and probability of successful reproduction), potentially affecting how individuals utilize resources, including prey. When individual variation is scaled up to an entire population, it could affect the ability of an apex predator to fulfil its regulatory role, or even its probability of long-term persistence. Camera traps are widely used to monitor large carnivore populations and can potentially record visual evidence of injuries. However, no previous study, to our knowledge, has quantified the number or nature of injuries from camera trap data. We reviewed jaguar images from camera-trapping data collected in 2018 and 2017 in Belize and classified visible injuries into 7 categories (e.g. “small laceration,” or “eye dysfunction,” in which one eye did not reflect light the same way that the healthy eye would). We found that 43.3% of the individuals sustained at least 1 injury over these 2 years. The largest percentage of injuries were small lacerations (49.4%). The second largest percentage of injuries were medium lacerations and eye dysfunctions (both 12.6%). We plan to review additional years of data to examine whether space-use varies in conjunction with injury status. This technique could also be easily transferred to other animals that are caught on camera traps, allowing for a non-invasive method to collect data on injuries or individual fitness.

**Mentor(s):** Marcella Kelly (Department of Fish and Wildlife Conservation), Virginia Tech
Rob Nipko (Department of Fish and Wildlife Conservation), Virginia Tech

**Wenjing Yu**
Virginia Tech/Biological Sciences

**Influence of Ultra-processed Foods on  Reward Processing and Energy Intake**

Ultra-processed foods(UPF), defined by NOVA food system as entirely or mostly made by industrial food additives, has shown negative effects on human health and all-cause mortality in recent decades. Experiments with animals revealed UPF can alter the brain reward circuit in rats, and in 2019 a human study has shown that UPF led to excess food intake and weight gain. However, no experimental human research (using controlled feeding) has tested the impact of food processing on brain reward circuitry. In the US, the majority of obesity starts in adolescence, therefore, our study is focused on young adults(age 18-25). UPF and un/minimally processed food will be provided to the participants in a crossover of 2 weeks diet with a 4 weeks washout in between. fMRI will be conducted to measure the brain‚Äôs response to UPF milkshakes before and after each diet period. Other measurements such as executive function, eating in the absence of hunger, ad libitum intake at a buffet meal, etc, will also be collected to test the effects of the two different diets.
We hope the outcomes from this study can lead to a more comprehensive understanding of processed food and potentially improve dietary guidelines.

**Mentor(s):** Alexandra DiFeliceantonio (HNFE), Virginia Tech

**Lillian Zaccaria**
Virginia Tech/Human Development

**Charlotte Menke**
Virginia Tech/Human Development

**Jane Sciortino**
Virginia Tech/Human Development

**The Role of Parent Personality, Parenting Behaviors, and Child Temperament in Parent-Child Dyadic Interactions**

Families are complex systems whose members interact and influence each other's behavior (Kerr & Bowen, 1988). Personality and temperament may uniquely influence parent-child interaction. Parent personality characteristics have been linked to individual differences in parenting (Vondra et al., 2005). Personality traits like openness have been linked to more optimal parenting behaviors while personality traits like neuroticism have been linked to less optimal parenting behaviors during parent-child interaction (Mowder, 2005). Non-optimal parenting behaviors, such as negative affect, could play a significant role in the quality of parent-child dyadic interaction. Parent-child dyadic interaction refers to reciprocal engagement of parent and child during interactions. Because dyadic interactions emphasize the role of both parent and child, we should consider child characteristics as well as parent characteristics. In this study, we consider child temperament and parent personality as they relate to understanding dyadic interaction. We proposed the relation between parent neuroticism and dyadic interaction would be mediated by parenting negative affect at certain levels of child energy/activity level and attention focusing. Using two moderated mediation models, we examined these relations across 3 time points. 94 mother-child dyads visited the lab when the children were 30-36 months old (T1), again at 4-5 years old (T2), and finally at 8-9 years old (T3). Variables of interest were assessed via parent-report of self and of their child as well as through observational behavioral coding. Analyses indicated significant pathways where parenting behaviors mediated the relation of parent personality to parent-child dyadic conflict at certain levels of child temperamental characteristics.

**Mentor(s):** Cynthia Smith (Human Development), Virginia Tech
Meredith Atanasio (Human Development), Virginia Tech

**Hajar Zaheer**
Virginia Tech/Systems Biology

**Sequence effects on the aggregation dynamics of functional β-endorphin vs. cytotoxic amyloid-β**

Amyloids are a class of proteins marked by their tendency to aggregate into fibrils with a characteristic cross-β spine, yet they exist on a spectrum from functional, as in the case of the neuromodulator β-endorphin, to cytotoxic, as with amyloid-β infamously implicated in Alzheimer's disease. While the amyloid hypothesis has received scrutiny in recent years, a comparative study using MD simulations of multimer systems composed of peptides representing each sub-type can still yield valuable insights into underlying sequence differences that give rise to converse biological outcomes. An analysis of 1 μs (1000 ns) trajectories of hexamer systems of amyloid-β (n=3) and β-endorphin (n=4) was conducted in order to identify intermolecular residue pairs key to aggregation. By comparing the biochemical properties and sequence location of these residue pairs, it is possible to hypothesize about what causes differences observed in silico, such as the earlier formation of amyloid-β aggregates. Preliminary findings based on averaged first contact time curves suggest that in amyloid-β, there is a well-defined subset of residue pairs - many including Gly33 - that typically lead in contact formation, while in β-endorphin, the distinction is less clear. Additionally, amyloid-β intermolecular contacts tend to persist longer than those of β -endorphin. Residue pairs His14:Glu22 in amyloid-β, which potentially form a salt bridge, and Thr6:Glu8 in β-endorphin were identified as being the most persistent. MD data is information-rich and permits avenues of investigation to characterize aggregation pathways and delineate causative factors in ways that are not feasible through wet-lab approaches yet.

**Mentor(s):** Anne Brown (Biochemistry), Virginia Tech

**Violet Zaleski**
Virginia Tech/Human Nutrition, Foods, and Exercise

**Nithika Karthikeyan**
Virginia Tech/Clinical Neuroscience

**Harshini Venkat**
Virginia Tech/Computational & Systems Neuroscience

**May Kretzer**
Virginia Tech/Experimental Neuroscience

**Exploring the neuroplasticity of music to re-establish synchronized behavior and communication patterns between individuals with dementia and their caregivers.**

Globally, approximately 55 million individuals have been diagnosed with dementia, and almost 10 million new cases are identified annually. Our study offers multiple contributions towards identifying non-pharmacological approaches for alleviating symptoms of Alzheimer's Disease (AD) and assisting caregivers in managing these stress factors. Specifically, our research emphasizes the importance of using music listening and active music engagement as a means to promote positive emotional states. The power of music therapy: Investigating how it can improve social connectedness, interpersonal relationships, and mental health outcomes for individuals with Alzheimer’s Disease and their caregivers. Over the course of 12 weeks, we conducted weekly active music therapy sessions with participants and their like-minded care-partners. Participants wore an electroencephalogram (EEG) cap to record their brain activity during each session. All sessions were recorded using a 360 video device to assess correlations between brain activity and behavior. At present, our focus is on analyzing EEG data and utilizing a processing pipeline to obtain precise EEG information. Alongside this, our team of research assistants is actively engaged in reviewing video data and conducting movement analysis to supplement our findings.

**Mentor(s):** Joanna Culligan (Department of Human Development and Family Sciences), Virginia Tech

**Leila Zavar**
Virginia Tech/Clinical Neuroscience

**Autophagy proteins ATG9A and FIP200 regulate cell growth through TBK1 activation**

Cancer is a leading cause of death worldwide, which is primarily defined as the rapid onset of abnormal cell growth and disruption of normal cell division. Abnormal mitosis and insufficient cellular repair mechanisms increase the risk of illness. Cell survival is regulated by autophagy through the removal of damaged proteins and organelles to maintain homeostasis. Abnormal autophagy prevents the breakdown of these components and has been associated with both tumor suppression and promotion. Autophagy-related protein 9A (ATG9A) is a transmembrane protein essential for autophagosome maturation, which is responsible for transporting cargo for degradation. ATG9A colocalizes at the trans-golgi network (TGN) with adaptor protein 4 (AP4), which facilitates export to the cell periphery. Family interacting protein of 200 kD (FIP200) is a scaffolding protein and a key component of the autophagy-inducing ULK complex that aids in complex localization and stimulation in response to incoming autophagy signals. Tank binding kinase 1 (TBK1) is a kinase that regulates both autophagy and cell division. TBK1 is activated after autophosphorylation, and is located on centrosomes regulating mitosis. TBK1 inhibition leads to abnormal mitosis and the accumulation of multinucleated cells. Our study objective is to identify how ATG9A and FIP200 regulate TBK1 activity and trafficking during the cell cycle. Using a combination of shRNA mediated knockdown cell lines, gene editing of ATG9A and FIP200 via CRISPR, and immunostaining, we found that loss of ATG9A and FIP200 both cause abnormal activation of TBK1. Overactivated TBK1 was observed whether cells were asynchronous or in mitosis. Our data demonstrates that ATG9A knockout (KO) cells result in significant increases in the number of binucleated and multinucleated cells, while FIP200 KO cells result in significant increase in the number of micronucleated cells. ATG9A KO cells display a lower mitotic index, higher percentage of chromosomal instability, and abnormal mitosis. Future studies will determine how AP4 works upstream of ATG9A to regulate TBK1 activation.

**Mentor(s):** Alicia Pickrell (School of Neuroscience), Virginia Tech