39th Annual GPSS Research Symposium and Exposition

Looking to Our Roots: Finding Ways to Empower Connection through Community Engagement, Creative Collaboration, and Conscientious Research

March 29, 2023

Graduate Life Center | 9 am-6:30 pm

GENEROUSLY SPONSORED BY:

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KEYNOTE SPEAKER

Alaina E. Roberts

Assistant Professor of History | University of Pittsburgh

Alaina E. Roberts is an Assistant Professor of History at the University of Pittsburgh, where she studies the intersection of Black and Native American life from the Civil War to the modern day. Dr. Roberts is the author of *I've Been Here All the While: Black Freedom on Native Land*, which was awarded the Stubbendieck Great Plains Distinguished Book Prize and the Western History Association's John C. Ewers Award and W. Turrentine Jackson Book Prize. *I've Been Here All the While* was also a finalist for the Los Angeles Times Book Prize. Dr. Roberts has written multiple academic essays as well as op-eds and profiles for the Washington Post, TIME magazine, and High Country News.

2023 PROGRAM CHAIR

Kaylee Petraccione

Director of Programs

Cissy Ming

GPSS Advisor

Lauren Surface

Schedule Overview

8:00AM-9:00AM **Check In & Registration** **Graduate Life Center Lobby**

9:00AM-12:00PM **Oral Sessions 1 and 2**

Oral Session 1: Room B

9:00AM Jenny Liao
9:15AM Molly Ryan
9:30AM Hesam Mahmoudi
9:45 AM Tianming Zhao
10:00AM Zainab Shamim
10:15AM Nicole Lydic
10:30AM John Marshal
10:45AM Nicole Nunoo
11:00 AM Geoffrey Otieno
11:15 AM Dawson Beatty

Oral Session 2: Room C

9:00AM Catherine Cotrupi
9:15AM Aditya Sai Phutane
9:30 AM Leah Ramnath
9:45 AM Hesam Mahmoudi
10:00AM Zainab Shamim
10:15AM Lily Seah
10:30AM Sara Saghafi Moghadda
10:45 AM Holly Morrison
11:00 AM Amanda Wei
11:15 AM Ruhit Sinha
11:30 AM Tolulope Odimayomi

10:00AM-11:45AM **Poster Session 1** **Multipurpose Room**

1. Clint Lanham
2. Sarah Dixon
3. Caroline Begley
4. Loralee Hoffer
5. Leila Pruscino
6. Pallavi Rai
7. Christian Burrell
8. George Edwards
9. Hsin-Wen Liang
10. Colin Kelly
11. Vanessa Diaz Benitez
12. Ehab Salama
13. Charles Sterling
14. Yehia Elgammal
15. Kate Albi
16. Khan Mohammad Imran
17. Clares Pastrana Jorge A.
18. Elizabeth Sicking
19. Camryn Cook
20. Melanie Hempel
21. Baitong Liu
22. Mackenzie Woolls
23. George Edwards
24. Kathryn Hayes
25. Hoda Hammad
26. Sarah Juster
27. Abouelkhair Ahmed
28. Morgan Lindenmuth
29. Saadia Ali
30. Seun Imani
31. Andrew Gunsch
32. Chelsea Cereghino
33. Kayla Alward
34. Neeti Gandhi
35. Edward Jacobs
36. Anna Kurowski
37. Jonathan Joyce
38. Sounak Chakrabarti
39. Zaid Salameh
40. Nicole Lydic

12:00PM-1:00PM **Lunch** **Multipurpose Room**

Boxed lunches are available from Hethwood Market for Presenters, Volunteers, and Judges.

12:30PM-2:15PM **Poster Session 2** **Multipurpose Room**

1. Claudia Hilton
2. Ya-Yun Chen
3. Tyler Parker-Rollins
4. Kamla Al Amri
5. Erin Nuckols
6. Sahitya Ranjan Biswas
7. Jennifer Phillips
8. Molly Parker
9. Caroline de Jager
10. Julia Shapiro
11. Charlie Amoia
12. Renesa Tarranum
13. Brittany Heath
14. Evelyn Washburn
15. Babatomiwa Kikiowo
16. Joshua Neal
17. Nour Alkashef
18. Parker Rollins
19. Kassaye Belay
20. Mubarak Alrumaidhi
21. Jake Easton
22. Elham Nasarian
23. Kathleen Hohweiler
24. Jatia Mills
25. Morgen VanderGiessen
26. Abdullahi Jamiu
27. Rebekah Miller
28. Bruce Barbour
29. Nicolas Burns
30. Clint Lanham
31. Molly Parker
33. Evelyn Washburn
34. Babatomiwa Kikiowo
35. Zaid Salameh
36. Lauren Ruger
37. Hannah Patton
38. Rebecca Kriss
39. Katelyn Stebbins

2:00PM-4:00PM **Oral Sessions 3, 4, & 5**

Oral Session 3: Graduate Life Center Room B

2:00PM Tristan Stoyanof
2:15PM Mitch Caudill
2:30PM Thomas Carnes
2:45PM Sarah Khatibzadeh
3:00PM Ahmed Meselhy
3:15PM Md Doulotuzzaman Xames
3:30 PM Josefa Garcia

Oral Session 4: Graduate Life Center Room C

2:00PM Jennifer Alexandra Thompson
2:15PM Muskan Gupta and Emily Altland
2:30PM Corinne Carlton
2:45PM Delshad Shroff
3:00PM Jasmine Lewis
3:15PM Emily Tirrell
3:30PM Brie Trusiano
3:45PM Lauren Helber

Oral Session 5: Graduate Life Center Room F

2:00PM Greyson Moore
2:15PM Razan Alajoleen
2:30PM Tosin Ogunmayowa
2:45PM Sounak Chakrabarti
3:45PM Trevor Jeyaraj
3:00PM Alexandra Kaloss
3:15PM Modiu Olaguro
3:30PM Elizabeth Chishimba

4:30PM-7:00PM Keynote Speaker, Dinner, and Awards Ceremony Multipurpose Room
This event is for presenters, volunteers, and faculty judges who RSVP'd.
Dr. Alaina E. Roberts, an award-winning black and indigenous historian, author of "I've Been Here All the While: Black Freedom on Native Land", and assistant professor from the University of Pittsburgh will be speaking on the topic of "Strength in Diversity: Using Knowledge of the Past to Create Present Relationships."

ABSTRACTS FOR POSTER AND ORAL PRESENTATIONS (IN ALPHABETICAL ORDER BY SURNAME)

Topical Azoles: is this the treatment for Clostridioides difficile infection (CDI)?

Authors: Ahmed A. Abouelkhair, Nader S. Abutaleb, Mohamed N. Seleem

Presenter: Ahmed A. Abouelkhair | Poster presentation

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Clostridioides difficile is a prominent source of healthcare-associated infections and is regarded as an urgent public health problem globally. The only FDA-approved antibiotics for the treatment of C. difficile infection (CDI) are vancomycin and fidaxomicin. The high rate of treatment failure and recurrence linked to these antibiotics, as well as the rising number of infections, make CDI treatment extremely difficult. Therefore, it is imperative to find new, powerful anti-C. difficile drugs. When compared to de novo drug innovation, drug repurposing is a potential technique for reducing costs and time and decreasing risks associated with de novo drug discovery. Utilizing this approach, we screened 3200 FDA-approved drugs against C. difficile, and the results showed that miconazole is a powerful inhibitor of the bacterium with a minimum inhibitory concentration (MIC) of 1 µg/ml. On the strength of this, we tested a library of 24 azoles against a diverse range of pathogenic C. difficile strains. Miconazole, econazole, and tioconazole displayed the most potent activity against C. difficile inhibiting the growth of 50% of tested isolates (MIC50) at concentrations of 1 µg/ml, 2 µg/ml, and 2 µg/ml, respectively. Miconazole was selected for further investigation since it demonstrated the most potent anti-C. difficile activity, and it is orally bioavailable. In a time-kill kinetics study, miconazole showed a fast bactericidal activity outperforming vancomycin, where it decreased a high bacterial inoculum by more than 3 log10 within 2-4 hours and completely cleared the bacterial burden after 4 hours. Physicochemical properties of miconazole including, the effects of pH, preexposure to simulated gastric fluid (SGF), and simulated intestinal fluid (SIF), were also examined. High pH values did not affect the miconazole's antibacterial action, and it retained the same potency after being exposed to SGF and SIF. Furthermore, miconazole did not show inhibitory activity against key species that compose the host intestinal microbiota and showed a prolonged post-antibiotic effect (PAE) (>6 hours) exceeding that of the drug of choice, vancomycin. Overall, these results indicate that miconazole merits further investigation as a potent and selective anti-clostridial agent to replenish the dry pipeline of new anti-C. difficile therapeutics.

Faculty Development Program To prepare Faculty for Online teaching

Authors: Kamla Al Amri

Presenter: Kamla Al Amri | *Poster presentation*

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This integrative literature review aims to identify guidelines that could be used to form the basis for creating a faculty development program to teach online in higher education. In other words, this scholarly review is meant to create a set of guidelines for designing a program (synchronous and asynchronous) for computer-based instruction/ online teaching. To date, there is a lack of institutional maturity when it comes to online teaching. The researcher proposes a model for faculty development program to prepare them to teach online and be effective online instructors. Within this model, a set of criteria for successful online teaching and delivery will be discussed. The review is mainly guided by three major questions. These are: 1) What does the current literature say about the necessary elements of a faculty support plan for online teaching programs at the university level? 2) Who are the stakeholders involved in creating faculty development programs for online instruction programs? 3) What guidelines are recommended in the current literature about designing and developing faculty development programs for online teaching programs at the university level? Findings of this study should offer guidance to tertiary education teaching faculty, instructional designers, university management and policy makers on how to go about creating an effective faculty development program to teach online at any institution.

Single-Cell RNA Sequencing Reveals Disease Stage-Dependent Transcriptomic Profiles of Regulatory B Cells in Systemic Lupus Erythematosus

Authors: Razan Alajoleen, Andrea Daamen, Prakash R. Timilesena, Song Li, Peter E. Lipsky, Xin Luo

Presenter: Razan Alajoleen | *Oral presentation*

Corresponding author e-mail: arazan@vt.edu

Systemic lupus erythematosus (SLE) is an autoimmune disease associated with abnormal activation of immune cells. Regulatory B (Breg) cells are a B cell subset that negatively regulate immune responses via secretion of immunoregulatory cytokines interleukin (IL)-10, IL-35, and transforming growth factor (TGF)-β. We had previously shown that in lupus-prone MRL/lpr mice, pre-disease Breg cells were more potent in suppressing autoimmunity than active-disease Breg cells. In this study, using single-cell RNA (scRNA) sequencing, we profiled ~10,000 Breg cells from female MRL/lpr mice at the pre-disease (6-8 weeks of age) vs. active-disease (10-12 weeks of age) stages. Based on known markers of Breg subsets, scRNA analysis identified respective clusters as transtional-2 marginal zone precursor B cells (T2-MZP), marginal zone B cells (MZB), transitional 1 B cells (T1), germinal center B cells (GC), and B1 B cells. Our data showed that the pre-disease Breg cells were predominantly T2-MZP and MZB cells. Follicular B cells outside the marginal zone, on the other hand, are significantly increased in the active-disease stage. Two long noncoding RNAs (lncRNAs), Malat1 and Xist, were significantly increased in active-disease Breg cells, where the expression of Lglas3, Slpi, and Spp1 was also increased. Notably, active-disease Breg cells exhibited an exhausted phenotype with increased expression of T-bet (Tbx21). Collectively, our findings suggest that the SLE disease stage-dependent functions of Breg cells are regulated at the transcriptional level. In future experiments, we will determine whether the immunosuppressive functions of active-disease Breg cells can be restored by knocking down the differentially overexpressed genes.

Implications of bottled water reliance in rural West Virginia

Authors: Kate Albi, Leigh-Anne Krometis, Alasdair Cohen, Kang Xia, Austin Gray

Presenter: Kate Albi | *Poster presentation*

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Over the past ten years, an increasing number of Americans are choosing to rely on more expensive, less regulated, and environmentally destructive commercial water sources, such as bottled water, over-in-home sources This change in water consumption in the United States parallels broadening perceptions of poor water quality and/or distrust in public water authorities. For some communities, these perceptions are often valid: a recent examination of US Census and Safe Drinking Water Act (SDWA) violation data demonstrates that rural low-income and minority communities are significantly more likely to be burdened with unavailable and/or unsafe in-home drinking water. There is therefore increasing concern that traditionally disadvantaged populations are bearing greater and generally unknown economic and health impacts associated with bottled water reliance. This research aims to evaluate the different water quality, uses, and perceptions of both in-home piped and bottled water in McDowell County, West Virginia. Over 30% of county residents live with incomes below the poverty line, and concerns regarding in-home water quality and availability are widespread. Fourteen households were recruited in partnership with local nonprofit organizations. All participants were asked to complete a brief survey detailing use, perceptions, motivations, and expenditures (both time and money) related to in-home piped and bottled water use, if applicable. Primary home samples have been collected and analyzed for traditional markers of water quality (fecal indicator bacteria, metals, nutrients) and emerging contaminants (microplastics, PFAs species). Of the fourteen homes sampled, approximately 65% of residents reported bottled water as their primary, year round drinking water source. The most common PFAs species (PFOs and PFOAs) were notably identified in the samples of all five homes dependent on hauling stream water. Collection of bottled water from primary locations identified in household surveys is scheduled for next month, with parallel water quality results expected by March.

Translanguaging Practices: Switching Anxiety and Fear to Motivation and Empowerment in the acquisition of English as a Second Language (ESL)

Authors: Saadia Ali

Presenter: Saadia Ali | *Poster presentation*

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In this qualitative research proposal, I aim to focus on an important multilingual phenomenon, namely translanguaging. Translanguaging is the use of native language by English Language Learners (ELLs) in learning English as a Second Language (ESL). A brief introduction of translanguaging practices will be presented based on the existing literature and its effect on bilinguals in the development of literacy skills. There will be keen attention on learner's native language context in second language learning to ensure a sense of belonging and connection with one's roots throughout the research process. Besides, I will attempt to investigate the amount of foreign language anxiety and fear that learners face while learning English as a Second Language (ESL). There will be reinforcement on the possible ways in which subject matter experts (SMEs) can incorporate methodological practices under the lens of translanguaging and culturally responsive teaching strategies in their instruction in ESL classrooms. Similarly, incorporation of translanguaging practices improving motivation and empowerment in the acquisition of second language during class activities and the meaning English Language Learners (ELLs) create from discussions to meet language and content objectives will be highlighted. Salient questions will be answered during the research phase via lesson plans with follow up written and spoken assignments and relevant series of interviews based on translanguaging. Moreover, procedures, results and finally conclusion of the study will be presented along with the appendices and participants samples. The research guided question is:

How does incorporation of translanguaging practices improve English Language Learners (ELLs) experience in the acquisition of English as a Second Language (ESL)?

1. Why English Language Learners (ELLs) face anxiety and fear while learning English as a Second Language?

2. How does incorporation of translanguaging practices improve motivation and empowerment among English Language Learners (ELLs) while learning English as a Second Language (ESL)?

Ritonavir, a promising cost-effective adjuvant to amphotericin against cryptococcal meningitis infections.

Authors: Nour Alkashef

Presenter: Nour Alkashef | *Poster presentation*

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Cryptococcus neoformans causing life-threatening meningitis and represents an alarming global health threat associated with high mortality among immunocompromised individuals and HIV patients. The current arsenal of antifungal drugs to combat the growing problem of cryptococcus is very limited. Amphotericin B is the front line treatment for cryptococcal meningitis. However, the treatment with amphotericin B is commonly associated with severe adverse effects. In this study, we used the combinatorial approach to minimize the toxicity and to enhance the efficacy of amphotericin B against C. neoformans. We evaluate the HIV-protease inhibitor, ritonavir, as a potential co-drug to work synergistically and to enhance the effectiveness of amphotericin B treatment. Ritonavir exhibits potent in-vitro synergistic interaction when combined with amphotericin B against 100% (15/15) of the tested C. neoformans isolates with a fractional inhibitory concentration index (ΣFICI) ranging from 0.07 to 0.31. Notably, the combination of ritonavir with amphotericin B led to killing of all tested isolates within 3 hours as measured by time killing assays. As a part of the involved mechanistic study, ritonavir significantly interferes with glucose transport in C. neoformans reducing its uptake by 52%. These data highlight the potential of antifungal combination between amphotericin B and ritonavir to combat C. neoformans infections. Furthermore, these data will provide insight into the potential clinical usefulness of ritonavir because it is commonly administered in HIV-infected patients and cryptococcus is a leading cause of morbidity and mortality in those patients.

Factors Affecting Crash Severity Among Elderly Drivers: A Multilevel Ordinal Logistic Regression Approach

Authors: Mubarak Alrumaidhi

Presenter: Mubarak Alrumaidhi | *Poster presentation*

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This study modeled the crash severity of elderly drivers using data from the state of Virginia, United States, for the period of 2014 through to 2021. The impact of several exogenous variables on the level of crash severity was investigated. A multilevel ordinal logistic regression model (M-OLR) was utilized to account for the spatial heterogeneity across different physical jurisdictions. The findings discussed herein indicate that the M-OLR can handle the spatial heterogeneity and lead to a better fit in comparison to a standard ordinal logistic regression model (OLR), as the likelihood-ratio statistics comparing the OLR and M-OLR models were found to be statistically significant, with p-value of <0.001. The results showed that crashes occurring on two-way roads are likely to be more severe than those on one-way roads. Moreover, the risks for older, distracted, and/or drowsy drivers to be involved in more severe crashes escalate than undistracted and nondrowsy drivers. The data also confirmed that the consequences of crashes involving unbelted drivers are prone to be more severe than those for belted drivers and their passengers. Furthermore, the crash severity on higher-speed roads or when linked to high-speed violations is more extreme than on low-speed roads or when operating in compliance with stated speed limits. Crashes that involve animals are likely to lead to property damage only, rather than result in severe injuries. These findings provide insights into the contributing factors for crash severity among older drivers in Virginia and support better designs of Virginia road networks.

Effect of Daylength and Breed on Colostrum Production in Cows

Authors: Kayla Alward

Presenter: Kayla Alward | *Poster presentation*

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Unlike most mammals, the cow has a unique placenta, which prevents the transfer of immune cells to their offspring during pregnancy. Instead, cells are transferred to their first milk, known as colostrum, so when the calf ingests its first meal, it absorbs the cells through the digestive tract and establishes an immune system. Calves not receiving colostrum have survival rates less than 50%. Unfortunately, 25% of cows do not produce adequate quantities of colostrum or it is poor quality – evidenced by few immune cells. Previous research shows that milk production is influenced by light exposure, so, we hypothesized that altering light exposure to pregnant cows can impact the quantity and quality of colostrum produced. Two breeds of cows were housed in a light controlled barn and exposed to either short-day photoperiod (SDPP) of 8 hours of light per day or long-day photoperiod (LDPP) of 16 hours of light per day for their last 2 months of pregnancy. After giving birth, colostrum volume was measured and a sample was collected to measure various components (fat, protein, other solids, lactose, lactoferrin) and immune cell number (IgA, IgG, IgG1, IgM) and Brix score, an indirect measure of immune cell number. Data were analyzed with the PROC MIXED procedure of SAS 9.4 with fixed effects of breed and photoperiod treatment. Replicate, animal age, number of days of treatment, season of calving, genetics and previous production were included as random effects. None of the values differed by photoperiod exposure ($P > 0.10$), however, one breed of cow had higher Brix score, colostral protein and IgA ($P < 0.01$), and a tendency for fat and IgM to be greater as well ($P < 0.10$). These data indicate that colostrum may not be impacted by light exposure, but colostrum quality may vary by breed of cow.

Genetic diversity of Newcastle disease virus involved in the 2021 outbreaks in backyard poultry farms in Tanzania

Authors: Charlie Amoia

Presenter: Charlie Amoia | *Poster presentation*

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Newcastle disease virus (NDV) is a major avian pathogen that causes significant economic losses worldwide. A range of distinct NDV genotypes are currently causing outbreaks worldwide. Due to the vast genomic diversity of NDV, diagnostic failures are more likely to occur, potentially leading to undetected infections and, ultimately, to larger outbreaks with massive economic losses. Thus, a more comprehensive understanding of the circulating NDV genotypes is critical to reduce Newcastle disease (ND) burden. In this study, NDV was isolated and characterized from backyard poultry farms in Tanzania, East Africa in 2021. We performed reverse transcription polymerase chain reaction (RT-PCR) on 79 cloacal swabs or tissues from suspected ND outbreaks in chickens to detect the NDV fusion (F) gene, and identified 50 positives out of 79 total samples (63.3%). Sequencing and phylogenetic analyses of 40 selected NDV isolates showed that 39 belonged to sub-genotype VII.2 and one to sub-genotype XIII.1.1. Sequences of these F genes from Tanzania were closely related to recent viruses circulating in southern Africa, suggesting that subgenus VII.2 is now present in East Africa after having spread widely throughout southern Africa and causing severe poultry epizootics in Southeast Asia. Our data confirm the circulation of two major NDV genotypes in Tanzania, providing important information to design genotype-matched vaccines and to aid ND surveillance in the region. Finally, these results highlight the possibility of the spread and emergence of new NDV subgenotypes with the potential to cause future ND epizootics.

Keywords: Newcastle disease virus (NDV); Tanzania; East Africa; Poultry; Genotypes; Phylogenetic analyses.

Distributed Space Adaptive Communications and Security for Multi-Constellation Networks

Authors: Bruce Barbour

Presenter: Bruce Barbour | *Poster presentation*

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Rapid growth in the rate of commercial space launches and operations are changing the economics of low-Earth orbit (LEO), the layer between our planet and outerspace. Satelliteenabled telecommunication companies, including OneWeb, have since in 2012 deployed a plethora of spacecraft to construct a globally interconnected constellation network. With the new era of satellite Internet arising, the combination of sprouting telecommunication firms, government programs, and recent changes to remote learning and working requirements create the framework for successful public-private partnerships (PPPs) led by universities to tackle the associated hard problems. These challenges include supplying coverage to unconnected/underconnected regions and communities and implementing security of the new network paradigms. Under the collaboration of Virginia Tech and the University of Surrey, a space-based highbandwidth networking testbed has been built to address the cybersecurity challenges of inter- and intra-constellation communications. Using a hardware-in-the-loop software architecture enables the hardware variation in noise and efficiency characteristics, allowing for realistic experimentation and research. Inter-constellation communication is achieved through VPN tunneling among different testbeds that host their own satellite constellation models. With modularity in mind, the testbed is scalable to include multiple space-based networks and ground sites. A preliminary resiliency study was performed for a simple connection between New York City (US) and London (UK) ground sites through inter-satellite links utilizing the current Starlink network. The infrastructure of the testbed is novel due to its ability to be integrated with other testbeds and thus its capability to emulate multi-constellation networks, as well as the hardware and simulation integration. Therefore, the testbed is capable of answering a number of research questions and is continuously being developed through partnerships among academic and private sectors.

Analysis of Long-Range Cellular Radio-SLAM Navigation Approximated as a Periodic System

Authors: Dawson Beatty

Presenter: Dawson Beatty | *Oral presentation*

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Work in recent years has demonstrated navigation capabilities using an unchanging set of cellular signals of opportunity in a predefined area, but the question of how such a scheme would fare over long-duration flights remains unanswered. This work presents a feasibility study examining the expected performance of a navigation algorithm relying on cellular signals of opportunity. The problem is posed as a simultaneous localization and mapping problem, since the states of the cellular signals must be jointly estimated with the user's position and velocity. This work explores how much information about the position and clock bias states of the cellular signals in order to make a useful navigation system. An analysis method for determining the steady-state covariance is also derived by assuming that the system is periodic. Simulated results show that in a typical route with reasonable assumptions, a position RMSE of 12 m might be obtained. This study shows that cellular signals of opportunity are a feasible option for long-duration navigation, especially if the route can be flown more than once to obtain better estimates of cellular site positions.

Understanding Emerging Adults' Coping Strategies while Transitioning to College during the COVID-19 Pandemic

Authors: Caroline Begley

Presenter: Caroline Begley | *Poster presentation*

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Times of transition are laden with ambiguity, and the move from high school to college has an additional component of role changes to add to this uncertainty. In the spring and summer of 2020, this transition was disrupted by the changes brought on by the pandemic, affecting social norms, routines, and overall mental health outcomes. For professionals such as counselors and advisors to be able to provide specialized support, it is important to understand emerging adults' experiences at this time and to identify factors that helped them cope with this transition. Understanding the development of coping strategies has direct implications for both therapy and clinical practice which can work together to provide a higher quality of care for the people affected by the stress of major life transitions. In this proposed study, I will use a mixed-methods design to understand the experience of emerging adults who graduated during the pandemic, and the role of tolerance for ambiguity in developing and utilizing adaptive coping strategies. R1: Is there an association between tolerance for ambiguity and coping behaviors in emerging adults navigating transitions? R2: Is there an association between tolerance for ambiguity and resiliency in emerging adults navigating transitions? R3: Is there an association between tolerance for ambiguity and the perception of the psychological impact of the COVID-19 pandemic on emerging adults?

A whole genome-based taxonomy of the genus Fusarium

Authors: Kassaye Belay, Mazloom R., Heath L. S., Vinatzer B. A.

Presenter: Kassaye Belay | *Poster presentation*

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Fusarium species are among the most important fungal pathogens because of their plant pathogenicity and their production of mycotoxins, which are known to affect both animal and human health. Even though extensive research on Fusarium has advanced our understanding of this genus, the taxonomy of its species and species complexes is still a controversial issue and needs to be addressed. It can be expected that genome sequencing and genomic analyses will overcome some of the limitations of more traditional taxonomic techniques. Also, to contain disease outbreaks before they reach an endemic or pandemic level and limit their adverse effect on crop production, genome-based taxonomy needs to be fast, precise, and accurate. This can be done through either whole genome sequencing, after isolation of pure culture, or metagenomic sequencing, without culturing of the pathogenic agent. To make progress towards a whole genome-scale phylogeny of the Fusarium genus and examine poorly resolved relationships among species, we used a combination of the tool BUSCO (Benchmarking Universal Single-Copy Orthologs) to identify single copy genes, MUSCLE to align BUSCO genes, TrimAl to remove poorly aligned sequences and IQ-Tree to construct a core genome tree for 276 fungal species and sub-species. In addition, we implemented Sourmash; a computationally efficient kmer based method, and the Life Identification Number (LIN) system for whole genome-based classification and identification. The Sourmash and the LINflow approach results were comparable and provided a tree similar to a core genome tree constructed on 391 single copy genes. We will show examples of how the above-described approaches and tools can be used for whole genome-based classification and identification of Fusarium and other fungal genera to improve plant health and, therefore, food safety and security.

Determining the effects of mitochondrial damage and defective mitochondrial quality control on neurogenesis

Authors: Sahitya Ranjan Biswas, Nicole DeFoor, Samantha Brindley, Alicia M. Pickrell

Presenter: Sahitya Ranjan Biswas | *Poster presentation*

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Mitochondrial dysfunction in neurons is a common feature of aging associated neurodegenerative disorders, such as Alzheimer's and Parkinson's disease, suggesting the importance of maintaining a healthy pool of mitochondria in cells that cannot divide. Cells recycle damaged mitochondria by trafficking them to the lysosome by a process called mitophagy. Our recent work has found that cells stop proliferating during mitophagy to ensure daughter cells do not inherit damaged mitochondria. Neural stem cells (NSCs), which divide and differentiate into neurons, exhibit elevated levels of mitophagy. Defective mitophagy has been observed in common neurodegenerative disorders; however, the impact mitophagy has on neurogenesis is relatively unknown. Thus, we hypothesize that mitochondrial damage and defective mitophagy impair neurogenesis affecting stemminess and NSC differentiation. To test our hypothesis in vitro, we use two different fluorescent mitophagy reporters: mKeimaXL and mitoQC. These constructs will allow us to observe and quantify mitophagy. Using the mKeimaXL construct, preliminary findings observed a peak in mitophagy at day 3 of neural stem cell differentiation. Using genetic mouse models of defective mitophagy (Pink1 or Parkin knockout mice), we are crossing these mice with mice with defective mitochondria to test how neurogenesis is impacted. Previous groups have described that chronic exposure to low oxygen level (hypoxia) prevented and reversed neurodegeneration in our mouse model of mitochondrial dysfunction. Hypoxia also induces mitophagy. Future plans include using our mouse models exposed to hypoxia to determine if hypoxia induced mitophagy improves neurogenesis and alleviates neurodegeneration. This work will provide us with important insights into physiological importance of mitochondrial quality control during neurodevelopment and degeneration.

The fungus among us: Counteracting azole resistance in *Aspergillus* species with lopinavir

Authors: Nicolas Burns

Presenter: Nicolas Burns | Poster presentation

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Aspergillus fumigatus is responsible for nearly 200,000 infections annually with a mortality rate of 40-95%. There is an imminent need to discover a novel therapy because the fungus is gaining resistance to frontline treatment. To meet this need, we screened ~3000 FDA-approved drugs to determine drug candidates capable of enhancing of a frontline antifungal, posaconazole. We identified a HIV protease inhibitor, lopinavir as a potent potentiator of posaconazole. Lopinavir acted synergistically with posaconazole against 84% *Aspergillus species* strains tested and reduced necessary posaconazole doses up 6 fold. Additionally, lopinavir showed great potential to interfere with fungal efflux pump machinery which act as a primary resistance mechanism. This enhanced antifungal drug retention by up to 80%. This retention allows for low concentrations of posaconazole to kill *A. fumigatus* through the formation of carbohydrate patches resulting from disruption of a crucial protein for cell wall maintenance. Lopinavir through these studies has shown its ability as a novel co-drug for antifungal therapy.

Can Social Anxiety Disorder Diagnosis be Predicted through Speech? A Preliminary Application of Convolutional Neural Network Modeling.

Authors: Christian Burrell, Corinne Carlton-Smith, John Richey

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Introduction: Social anxiety disorder (SAD) is an impairing psychiatric diagnosis with a lifetime prevalence of approximately 13%, ranking it as the second most common anxiety disorder diagnosis. The current "gold standard" for assessing anxiety disorders is through clinician administration of interviews such as the Anxiety Disorders Interview Schedule (ADIS-5). It takes approximately two hours to administer the ADIS-5 and one-to-two years to train a human rater to make reliable diagnoses with the ADIS-5. We sought to explore the question of whether a deep learning (Convolutional Neural Network) model could achieve diagnostic accuracy for SAD that is comparable to a human rater, while requiring only seconds to train rather than years.

Materials and Methods: In this study, we used transcripts from 8 participants who completed the ADIS-5 with a trained doctoral student clinician. The original data was in the form of audio recordings which were transcribed by an experimentally blinded research assistant into text. 50% (N=4) of the participants were diagnosed with SAD by the human clinician, and 50% (N=4) were confirmed to have no anxiety disorder diagnosis. We used natural language processing with Bloom embeddings as implemented in Spacy (Honnibal & Montani, 2017) to train, and then predict diagnosis for the data.

Results: The model stopped without improvements after its 400th batch with no increase in its Fscore of .33 - an indication of poor precision and recall. Random chance performance would predict an F score of 0.25, so the model although poorer than a human rater, still outperformed chance.

Conclusion: A CNN model for natural language processing of ADIS interviews currently shows promise as evidence by better-than-chance performance; however, a larger sample is required to train a model that would be able to accurately detect SAD through speech alone, much less at an accuracy comparable to a human rater.

Heterogeneity in Acceptance of Peers in a Novel Social Feedback Task: Exploring Voting Patterns of Sexual Orientation- and Gender-Diverse Socially Anxious Youth

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Social anxiety disorder (SAD) onsets in adolescence carries a significant burden on the development of peer relationships. Prior work has suggested that adults with SAD view themselves as being perceived negatively by others and view others more negatively. However, it is unclear whether teens with SAD also carry this negative perception bias and whether demographic characteristics (e.g., gender identity, sexual orientation) impact their judgment of peers. Thus, the present study aimed to assess how diverse socially anxious teens judged peers. 28 adolescents (ages 13-17, Mage = 15.25, SD = 1.51) participated in a study utilizing a social feedback task. Our sample identified as cisgender women (53.6%), cisgender men (25%), transgender men (7.1%), and non-binary (14.3%). Further, our sample identified as heterosexual (39.3%), homosexual (10.7%), bisexual (21.4%), pansexual (10.7%), queer (14.3%), and “other” (3.6%). Average rates of rejection were calculated per round per participant. Independent t-tests were run to assess for significant differences in voting based on social anxiety status, gender identity, and sexual orientation. Results demonstrated significant positive differences in average votes to accept peers in adolescents with high versus low social anxiety across all rounds (βs =.276-.984, ps < .05) except for round 6 (β =.413, p =.09). Significant differences were found in average votes to accept peers in gender-diverse adolescents versus cisgender adolescents across all rounds (βs = .230-.999, ps < .05). Finally, significant positive differences were found in average votes to accept peers in sexual-orientation diverse adolescents versus heterosexual adolescents in rounds 4-6 (βs = .493- .999, ps < .05) but not rounds 1-3 (βs = .233-.384, ps > .05). Findings demonstrate that adolescents who have high social anxiety, identify as gender-diverse, or identify as non-heterosexual tend to accept peers significantly more than adolescents with lower social anxiety or those of cisgender or heterosexual status.

Freeze-Thaw Actions Resistance of Cement Mortar Containing Quarry Fines as Supplementary Cementitious Material

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Frost action, particularly cycling of freezing and thawing during seasonal temperature variations, is a major durability concern for concrete and other building materials. This study explored the freeze/thaw durability of cement mortars that contained a quarry by-product known as quarry fines. As Virginia is the nation's 8th largest producer of crushed stone, the state is faced with an estimated 12 million tons of stockpiled quarry by-products that possess little commercial value. A total of seven quarry fines samples were collected from around the state and mixed into cement mortars at a 5% replacement of cement. Once hardened, the mortars were subjected to freezing and thawing action in water and saltwater environments. All but one of the quarry fines exhibited worse freeze/thaw resistance than the control sample without quarry fines. Further study is needed to assess why only one of the quarry fines performed well.

Control of AHL-Sensing Proteins in the Bacterial Pathogen Brucella abortus

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Brucella are bacteria that cause brucellosis, a long-lasting infectious disease that can result in arthritis, periods of fever, and severe fatigue. Despite its worldwide prevalence, vaccines for brucellosis have been difficult to generate. Brucella have mastered a stealth strategy to hide from the immune system, and, in fact, replicate in the very immune cells designed to kill them. How the Brucella know to begin replicating inside immune cells is a critical question. One of the important signals that Brucella are inside the cell is chemical called N-acetyl homoserine lactone (AHL). Brucella senses AHL through two proteins, which in turn alter the gene expression of the bacteria to allow it to survive and thrive inside immune cells. My research seeks to understand how Brucella controls these AHL-sensing proteins. How does Brucella know when to make these proteins and how much of these proteins to make? What are the interactions between these two proteins – do they act together or in opposition to each other? To answer these questions, I use a variety of genetic and biomolecular techniques to explore how each protein functions individually as well as how both function collectively to guide Brucella's behavior and responses. We have found that without these proteins, Brucella fails to infect mice and is readily cleared by the mouse immune system. Current work is examining the degree to which each protein controls specific stress responses, and how the proteins regulate each other's behavior. I am also examining how Brucella decides to turn these proteins on and off in response to conditions it encounters during the infection process.

Genetic determinants of the emergence of SARS-CoV-2

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Three years into the COVID-19 pandemic and neither a progenitor virus to SARS-CoV-2 nor a proposed mechanism of human emergence have been identified. Of the regions in the genetic material of SARS-CoV-2 that are thought to involve important functions for human emergence, very few have been validated experimentally. This leaves common barriers to human adaptation unexplored: the human immune system, which protects us from infections. We do not know how the progenitor virus had to mutate in order to antagonize the human immune system. However, identifying which mutations were important for infecting humans helps us find the most promising drug targets. Using this lens, we detected these positions which have not mutated since the start of the pandemic, show signals of competitiveness, and bear an identity that differs from all closely related coronaviruses that infect animals but not humans. We reconstructed SARS-CoV-2 with the identity from related coronaviruses, making a virus we predicted would behave more like the ancestor of SARS-CoV-2 and would have an advantage in animal infections but a disadvantage in human infections. We infected human cells, competing the ancestor-like virus with the virus from the beginning of the pandemic (the wild-type virus). We saw no difference between the viruses in human lung cells, but the ancestor-like virus may have a reduced advantage in other human cells. Ultimately, we will determine if the ancestor-like virus displays a different strategy of fighting the human immune system, and if it does, it would suggest the current identity in SARS-CoV-2 that infects humans today was important for human emergence and would represent a promising drug target.

Surrogate Deep Learning Models of Biomimetic Bat Sonar

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Bats have evolved highly advanced biosonar systems that combine information encoding in the physical domain by virtue of complex ear motions with neural extraction of information. In order to emulate this behavior, prior research has approximated the dynamics of bat pinna using fixed deformation patterns, e.g., by virtue of a lever deforming a silicone replica of a bat pinna. However, these systems could capture little of the known and suspected variability in the pinna motions that may allow bats to adapt to different sensing situations in their natural environments. As a first step towards exploring the use of variability in the acoustic characteristics of the bat pinnae, we have designed a deep-regression network that can predict the beampattern of deformed pinnae. To enable this, we have rigged a 3D tomographic reconstruction model of a hipposiderid bat's (Hipposideros pratti) pinna with three tendons that were used to test 10 actuator states each. All resulting shape deformations were then exported into a frequencydomain BEM model which predicted the ultrasonic beampatterns as function of the actuator states. Finally, we have reproduced the BEM beampattern prediction with two deep neural network architectures: a deep radial basis function neural network and a multilayer perceptron neural network. Both architectures were able to reproduce the BEM results. Since inference is computationally much less costly than BEM simulations, these deep-learning models for the link between pinna actuation and acoustic properties can be used for finding ways to harness the variability in the bats' pinna shapes using expensive training methods such as reinforcement learning.

Emotional Uncertainty's Effect on Avoidance Behavior in Risky Conflicts

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Individuals are confronted with conflicts every day and must choose to approach or avoid those conflicts by appropriately processing important information (Loijen et al., 2020). Studies found that individuals' emotional uncertainty tendency leads to avoidance behaviors because emotional uncertainty makes individuals overwhelmed easily by emotionally conflicted situations. We hypothesize that an individual with a higher emotional uncertainty tendency will show more avoidance from emotional challenges during situations that increase information processing to minimize emotional stress. Twenty-eight participants were recruited for the study (aged 19-26y, M=21.33±4.04, 50% female). Participants completed two tasks that measure participants' approach-avoidance behavior in two different conflicts. Participants decided whether to be involved in competitive conflicts with their opponents in the aggressive task and rescue victims from bullying conflicts in the prosocial task. They had ten out of 40 trials to avoid these conflicts in each task. Additionally, the Difficulties in the Emotion Regulation Scale was required to capture the tendency of emotional uncertainty. The results showed a significant positive correlation between emotional uncertainty and avoidance behavior in conflicts ($r=0.394$, $p=0.038$). In addition, analyses of the two tasks were done separately. The results showed a positive correlation between avoidance in the prosocial task and emotional uncertainty ($r=0.455$, $p=0.015$). However, the trend was not significant in the aggression task ($r=0.290$, $p=0.135$). The results indicated that emotionally uncertain individuals tend to avoid negative social interactions, especially when rescuing victims from bullying conflicts. The prosocial task involved a third person in the conflict, thus, it requires more overall information processing compared to the aggression task, which can lead to choosing avoidance. The current study can increase the understanding of how and why certain decisions are made in critical social interactions among peers.

Are U.S. consumers willing to pay a premium for bee-friendly beef?

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The loss in biodiversity has resulted in a decline in bee populations which threatens our food production systems due to the reliance of wild plants and agricultural crops on bee pollination services. Thus, the restoration of pollinator habitats calls for concerted efforts from all actors, including producers, retailers, and consumers. The analysis from this study identifies one incentive that can be used to encourage beef producers to contribute to the restoration of pollinator populations by adopting and maintaining wildflower-enhanced pastures on their ranches. This study examines consumer willingness to pay for bee-friendly beef using data from a nationwide choice experiment survey of 2,162 U.S. beef consumers. Using a fully correlated mixed logit regression we show that U.S. beef consumers prefer bee-friendly ground beef over conventional ground beef and are willing to pay $1.06 more per pound for bee-friendly ground beef. Willingness to pay varies depending on consumer characteristics with the highest WTP reported among consumers who volunteer/donate to an environmental organization ($2.06/lb) and those that are knowledgeable about pollinator decline ($1.79/lb). One implication of this study is the importance of bringing awareness among the public on pollinator decline to increase support for programs that conserve pollinators such as bees

Soil Nutrient Levels Associated with Salmonella Prevalence and Escherichia coli and Total Coliform Concentrations on Produce Farms

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Introduction: Soil can be a route of contamination of fresh produce. Growers routinely manage soil nutrient levels, and little research exists on synergistic or antagonistic effects on foodborne pathogens.

Purpose: This study aimed to (i) determine Salmonella prevalence, and generic Escherichia coli (gEC) and total coliforms (TC) concentration, and (ii) investigate macro- and micronutrient levels associated with each microbial target in soil.

Methods: Three produce farms in Virginia were selected from different regions (eastern, western, and northern VA). Farms were sampled four times to capture seasonal differences. Five soil samples were collected from 20 plots (25m2) and pooled in equal quantities to form one sample per plot. A total of 240 samples were collected. Samples (25g) were processed for Salmonella using a modified FDA BAM method, while samples (5g) were enumerated for gEC and TC using Petrifilm. PCR was used to confirm presumptive Salmonella-positive samples using a single gene (invA). Macro- and micronutrients were tested for each plot and evaluated for their association with each microbial target by a generalized linear mixed-effect model with farm as a fixed effect in RStudio.

Results: Salmonella prevalence was 4.2% (10/240) in soil samples. Of the ten Salmonella positive samples, nine samples (90%) were from one single farm in eastern VA. Potassium (mg/kg), iron (mg/kg), and manganese (mg/kg) influenced the likelihood of detecting a Salmonella-positive soil sample ($P \leq 0.05$). The average gEC and TC concentrations in soil samples were 1.23 (range 0.95-4.01) and 4.21 (range 1.23-7.12) log CFU/1mL, respectively. Phosphorus (mg/kg) and sodium (mg/kg) were associated with gEC levels in soil samples ($P \leq 0.05$), while calcium (mg/kg), potassium (mg/kg), sulfur (mg/kg), aluminum (mg/kg), iron (mg/kg), and manganese (mg/kg) were associated with TC levels ($P \leq 0.05$).

Significance: Findings show some soil nutrient levels were associated with Salmonella prevalence in VA soils, yielding a potential monitoring tool to forecast soil properties favorable for Salmonella.

Resisting White Supremacy Culture in Service Learning and Community Engagement: A Critical Narrative Analysis Deconstructing Faculty Members' Actions

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Official Abstract: The purpose of this study was to deconstruct how and to what extent white faculty members resisted upholding white supremacy culture (Okun, 2021) during a critical event (Mertova and Webster, 2019) in their service learning and community-engaged (SLCE) practice. Guided by critical event narrative inquiry (Mertova and Webster, 2019), I engaged six faculty members in two empathetic interviews on these topics framed in both first- and second-wave Critical Whiteness Studies (Badenhorst, 2021). I used Critical Narrative Analysis (Langdridge, 2007) to deconstruct the faculty members' experiences during these critical events (Mertova and Webster, 2019) in their SLCE practice. The intentions of this study were to uplift these actions in order to provide counter narratives to traditional practices within SLCE which may uphold Whiteness and characteristics of white supremacy culture (Okun, 2021). Through this study, I intend to be an accomplice in disrupting white supremacy culture (Okun, 2021) in service learning and community engagement.

Layperson's Abstract: In this study I interviewed white faculty members about their actions to address Whiteness and White Supremacy Culture in their research, pedagogy, and praxis. These faculty members are all employed at Land Grant institutions and are all service learning or community-engaged faculty. This means they are living out their institution's Land Grant values and mission daily through either engaging their students or engaging themselves in work to advance off-campus communities' goals and initiatives. By addressing Whiteness and White Supremacy Culture, their praxis is an example of critical, antiracist effort.

Single-cell Seq identifies Akap12 as a key capillary-specific gene involved in EphA4/Tie2 control of blood-brain barrier integrity

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An intact blood brain barrier (BBB) keeps the brain tissue healthy by preventing the passage of toxins and bacteria from the blood. Additionally, it limits immune cell infiltration and regulates cerebral blood flow. Traumatic brain injury (TBI) involves a complex cascade of events, starting with an initial insult followed by secondary injury, which can include BBB breakdown. In the context of TBI, disruption of the BBB is linked to worse clinical outcomes in patients in both the acute and chronic phases. The underlying mechanisms responsible for regulating BBB permeability following TBI remain to be elucidated. EphA4, a membrane bound receptor tyrosine kinase, has become of interest in many neurological disorders such as TBI, ALS, Alzheimer's disease, and Parkinson's disease. Our lab's findings indicate that genetic deletion of EphA4 (EphA4 KO) on endothelial cells reduced BBB disruption following the cortical controlled impact (CCI) model of TBI. The mechanism underlying this reduction in BBB disruption is still unknown. To better understand the cell specific changes in the brain microvasculature, we utilized single cell RNA sequencing of the damaged brain to compare wild type and EphA4 KO mice. Single cell RNA sequencing allowed us to identify changes in the mRNA of individual cells in the injured brain. This project revealed the influence of endothelial EphA4 on the transcriptomic landscape of the injured brain. We show that endothelial EphA4 mediates the expression of Akap12, which may interact with Tie2 receptor. Altogether, this data indicates a novel pathway which regulates BBB integrity following injury.

Middle Childhood Executive Functions and Parenting Behaviors Predict Adolescent Academic Skills

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Wide-ranging factors, such as executive functions (EF) and parenting, contribute to academic competence (Blair & Razza, 2007). Most of the research on EF, however, focuses on early childhood. We used a longitudinal design to examine EF and parenting behaviors during middle childhood and academic skills in adolescence, controlling for verbal IQ. Participants included 78 children who contributed data at ages 9 and 14. At age 9, children performed EF tasks, including backwards digits span (working memory), Wisconsin Card Sort Task (shifting/cognitive flexibility), and number Stroop (inhibitory control). They also completed the Peabody Picture Vocabulary Test (PPVT) as an assessment of verbal IQ (covariate). Mothers completed the CCNES (Coping With Children Negative Emotions Scale; Fabes et al., 2002; variable = non-supportive parenting scale). At the age 14 visit, adolescents completed the Woodcock Johnson IV (WJ) Applied Problems and Passage Comprehension. Two different hierarchical regressions were used to predict WJ Applied Problems and WJ Passage Comprehension from PPVT (Step 1 covariate), the three executive function tasks (Step 2) and nonsupportive parenting (Step 3). Results suggest different pathways to math and reading performance on standardized assessments in adolescence. After controlling for verbal IQ, Applied Problems performance was predicted by middle childhood inhibitory control, working memory, and parenting (all three steps of the model were significant, accounting for 46% of the variance in math performance). On the other hand, after controlling for verbal IQ, Passage Comprehension performance was predicted by middle childhood shifting/cognitive flexibility (the first two steps of the model were significant, accounting for 43% of the variance in the reading assessment). Future research on adolescent academic skills should focus on individual EF indicators, rather than EF composites, as well as parenting behaviors.

How Families Caring for a Relative with Dementia Got Through the Pandemic: Changes in Home and Community Based Services

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This study investigates the impact that COVID-19 had on the utilization of home and community-based service (HCBS) for persons living with dementia (PLwD) who resided in rural counties of Virginia. A longitudinal study on family caregivers was conducted before and throughout the pandemic, and data was obtained through both structured and qualitative telephone interviews. One-hundred and twenty-four family caregivers who cared for a PLwD were interviewed before the pandemic began. Three waves of interviews at different times during the pandemic were also collected. Interviews were conducted with 53 caregivers during the Stay-at-Home order (Wave 1), 50 caregivers when the Stay-at-Home order was lifted (Wave 2), and 27 caregivers when the Phase1B authorized COVID-19 vaccinations for older adults and their caregivers (Wave 3). At Wave 1, 33.96% of caregivers reported making changes to the HCBS they used for their relatives compared to pre-pandemic levels. Meal delivery services were added, however, transportation services, adult day services, in-home respite care, and participation in support groups were dropped. At Wave 2, 46% of caregivers had made changes to the HCBS they were using, with many adding in-home respite care for PLwD. At Wave 3, when COVID-19 vaccines became available, 59% of caregivers had made changes to the HCBS they were using. Many of them began using the services they previously had stopped using, some caregivers discovered novel ways to care for their PLwD, while others were unable to find care workers who could meet their PLwD's needs. Discussion of the paper will focus on the specifics of the changes in HCBS as well as the rationale behind the changes. The study findings provide insights about how the service use fluctuated during the course of the COVID-19 pandemic, as well as how rural Virginia can better prepare for future public health emergencies.

Communal Housing for Interns Plus Students

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In Washington, DC, at any given time, there are an estimated 20,000 interns making up nearly 3% of the city's population. They hail from every corner of the country and work with politicians, lawyers, think tanks, banks, lobbyists, etc. Until very recently, many of these interns went unpaid, including some 3,500 congressional interns, while others receive meager stipends. Additionally, there are approximately 85,000 college students attending universities in DC, with several more schools just outside the city. As more universities open satellite campuses in Washington and its suburbs without constructing residences for their students, more and more young adults are being squished into an already crowded housing market. As housing prices have skyrocketed due to supply shortages, many young adults have been forced to make hard decisions. Meanwhile, nearly 18% of office space remains vacant in the District as a result of changes in work habits caused by the pandemic. Through strategic rezoning, these office spaces can become prime real estate to house thousands of interns and students struggling to find affordable housing and rental terms that align with their respective programs. The proposed design solution takes advantage of a common commercial development practice known as "plug-and-play", in which blank office spaces are outfitted for a tenant's specific needs, adding walls, carpeting, and a fresh coat of paint, while utilizing existing support spaces including restrooms and mechanical systems. With this strategy, creating dorm style bedrooms and common areas to house interns and students becomes fairly simple. Shower rooms can supplement existing office building bathrooms, and strategically locating residences near public transit doesn't increase demand for parking. Renovating the facade can give drab office towers a refreshed look and new personality. This solution provides young adults access to affordable housing while building owners can redevelop buildings without evicting tenants.

Naloxone use behaviors among people with active opioid use disorder: A qualitative analysis using a behavioral specificity framework

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In recent years, opioid overdose mortality increased in the United States. The distribution of naloxone, an overdose antidote, is important, but ownership and carriage of naloxone is paramount to reducing mortality. People who use opioids (PWUO) can administer naloxone, but death is likely without ownership and carriage. While it is necessary to address addiction, we are interested in improving naloxone use. In our research, we applied the Actor, Action, Context, Target, Time (AACTT) framework, to identify where and when PWUO engage in their use of naloxone. We recruited 83 people with active opioid use disorder from two syringe services programs (SSPs) in south-central Appalachia. As part of a larger study, we applied single-blind randomization to a planning intervention (structured with AACTT) and a goal setting activity (without AACTT). We collected quantitative measures of attitudes, subjective norms, perceived behavioral control, and intentions towards naloxone use. During the planning or goal setting activity, we audio recorded 30-minute conversations with PWUO. We transcribed audio recordings and analyzed transcripts using thematic analysis with inductive reasoning. Overall, participants reported obtaining naloxone from local SSPs and medication-assisted treatment programs. PWUO described themselves as naloxone distributors in the community. Participants reported storing naloxone in their own home and carrying naloxone in a bag or car when traveling to homes, hotels, or motels. The physical location of naloxone is presented to peers when opioids are present and in use. Participants described the emotional context of talking with peers about naloxone and how this medication saved their life. Participants know to administer naloxone when someone is unresponsive and appears blue or pale. Naloxone is often described as the ‘worst feeling in the world.’ To our knowledge, this is the first study to use the AACTT framework with PWUO. Our next steps are to determine if conversations structured with AACTT improved ownership and carriage of naloxone.

Hope on the horizon: HIV protease inhibitor, atazanavir overcomes azole resistance in Candida auris infection

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Candida auris represents an urgent public health threat that has been linked to numerous outbreaks around the world and is associated with a significantly high mortality rate. Therapeutic options are currently limited to 3 main classes of antifungals (azoles, polyenes, and echinocandins) to treat *C. auris* infections. The limited treatment options and the upsurge of drug resistance in *C. auris*, prompted us to evaluate a library of FDA-approved drugs for their ability to restore the anti-*Candida* activity of azole antifungal agents. We identified the HIV protease inhibitor atazanavir, as a co-drug that can overcome azole resistance in *C. auris.* Atazanavir displayed a remarkable *in vitro* synergistic activity with itraconazole against 19/19 *C. auris* isolates with a fractional inhibitory concentration index (ΣFICI) that ranged from 0.09 to 0.38. Moreover, atazanavir restored the fungistatic activity of itraconazole against *C. auris* in an *in vitro* time-kill assay. Mechanistic studies revealed that atazanavir significantly interfered with *C. auris* efflux pumps which resulted in an increase in the Nile red fluorescence by ~50%. Additionally, atazanavir inhibited glucose transport and ATP synthesis, which caused the glucose utilization and ATP content in *C. auris* to decrease by 30% and 20%, respectively. When evaluated in a mouse model of disseminated candidiasis, the combination of atazanavir/itraconazole, along with ritonavir that serves as a bioavailability booster, significantly reduced *C. auris'* burden in murine kidneys, generating a 1.15-$\log_{10}$ colony forming unit (CFU) (~93%) reduction. Altogether, the data indicate that atazanavir is a potent azole chemo-sensitizing agent that merits further investigation.

KEYWORDS
HIV protease inhibitors, *Candida auris*, azole resistance, efflux pumps, ATP synthesis, glucose transport, *in vivo* disseminated candidiasis.

Maturation of iPSC-Hepatocyte-Like Cells in an Engineered 3D Liver Organoid for Hepatotoxicity Studies

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Approximately 23% of Americans take five or more prescription drugs daily. Adverse reactions to medications can cause drug-induced liver injury (DILI), which is the leading cause of acute liver failure in the U.S. Majority of DILI cases are idiosyncratic, where responses to medications vary amongst individuals. Currently, in vitro studies ideally use primary human hepatocytes. However, these cells are difficult to obtain. Induced pluripotent stem cell-hepatocyte like cells (iHLCs) exhibit significant potential as a more sustainable source for hepatotoxicity studies. iHLCs are retrieved non-invasively from skin cells and maintain host genotype, making them ideal for patient-specific studies. Although, widespread use is limited due to their fetal phenotypic characteristics. Therefore, we sought to investigate whether interactions with hepatic non-parenchymal cells (NPCs), other specialized hepatic cells, may improve liver functions in iHLCs. We have assembled 3D liver organoids that recapitulate the in vivo hepatic environment and architecture. Briefly, iHLCs are seeded on Type 1 collagen hydrogels. To assemble organoids, liver sinusoidal endothelial cells (LSECs) and Kupffer cells (KCs) are encapsulated in hydrogels of collagen and 1% (v/v) fibronectin on top. iHLCs cultured in a collagen sandwich serves as the control. Our engineered organoid, 3DHLK, showed ~15% and ~18% increase in intracellular albumin and decrease in hepatic nuclear factor-4α expression after seven and 14 days cultured in the organoid compared to control, indicating that iHLCs have matured with NPCs and time. An enzyme activity analysis revealed that 3DHLK at seven days exhibited ~21% and ~34% increase in apoptosis and necrosis, respectfully, after 24h of 5 mM acetaminophen, the leading cause of DILI, administration compared to untreated samples. We hypothesize that iHLCs are maturing due to signaling factors secreted by LSECs and KCs that occur during liver development and regeneration. Our future work will include adding other NPCs to further recapitulate the liver environment.

The T2-FLAIR mismatch sign as an imaging biomarker for canine oligodendrogliomas

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Background: In humans, the T2-FLAIR mismatch sign (T2FMM) is a specific magnetic resonance imaging (MRI) biomarker for IDH1-mutated, 1p19q non-codeleted low-grade astrocytomas (LGA). The T2FMM is characterized by a homogeneous hyperintense T2W signal and a hypointense signal with a hyperintense peripheral rim on FLAIR MRI sequences. On histopathology analysis, the T2FMM is correlated with the presence of microcysts in the mismatch regions. In canine gliomas, the T2FMM has not been described.

Hypotheses/Objectives: In dogs with focal lesions within the brain, T2FMM will discriminate gliomas from other pathologies. The T2FMM will be associated with the LGA phenotype and presence of microcysts on histopathology analysis. Interobserver agreement for the T2FMM MRI features will be high.

Animals: 186 dogs with evidence of focal lesions within the brain on MRI; 146 histologically confirmed gliomas including oligodendrogliomas (n=90), astrocytomas (n=47) undefined gliomas (n=9), moreover 33 with cerebrovascular accidents, and 7 with inflammatory lesions.

Methods: Two blinded raters evaluated the 186 MRI studies and identified cases with the T2FMM. Histopathologic and immunohistochemical slides of T2FMM cases were evaluated for morphologic features and IDH1-mutations and compared to cases without the T2FMM. Gene expression analyses were performed on a subset of oligodendrogliomas (n=10) with and without the T2FMM.

Results: T2FMM was identified in 14/186 (8%) of MRI, and all dogs with T2FMM had oligodendrogliomas (n=12 low-grade [LGO], n=2 high-grade [HGO]; P <.001). Microcystic change was significantly associated with the T2FMM (P < 0.00001). In oligodendrogliomas with T2FMM, IDH1-mutations or specific differentially expressed genes were not identified.

Conclusion and clinical importance: T2FMM can be readily identified on routinely obtained MRI sequences. T2FMM is a specific imaging biomarker for canine oligodendroglioma, and was significantly associated with non-enhancing LGO

Scattered Beam Monitors for the MOLLER Experiment

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The weak mixing angle is a number that determines how certain particles will interact and is thus a crucial quantity of the Standard Model of Physics. The MOLLER (Measurement Of a LeptonLepton Electroweak Reaction) experiment at Jefferson Lab will obtain the most precise measurement of the weak mixing angle at low energy to date. Electrons from Jefferson Lab's 11GeV electron beam will collide with and scatter off of the electrons in a hydrogen target. This process is known as Møller scattering. The MOLLER experiment will seek out and measure the differing rates of these moller events. A difference in the rates that correlates to helicity, a quantum property of particles, is an instance of parity-violating asymmetry. This asymmetry measurement will be used to extract the weak mixing angle. The experiment features collimators and toroidal magnets with a seven-sector azimuthal design that optimize separation of the signal of interest from backgrounds. Virginia Tech is responsible for designing, building, and testing the scattered beam monitor (SBM) systems. Beam electrons that scatter off of other parts of the apparatus rather than the target may produce false asymmetries in the rate. The SBM systems will monitor scattered particles for false asymmetries to ensure that the true asymmetry is measured.

Understanding Social Media Users' Perceptions of Trigger and Content Warnings

Authors: Muskan Gupta, Emily Altland, Sang Won Lee

Presenters: Muskan Gupta, Emily Altland

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Trauma is the physical, emotional, or psychological harm caused by deeply distressing experiences. With increased online interactions, social media content can trigger existing trauma and even re-traumatize a person. To combat this, social media users add trigger warnings (TW) or content warnings (CW) to posts dealing with sensitive content or content that can trigger someone's trauma(s). However, it is questionable if they clearly understand when and how to add TW/CW to their postings. The lack of shared understanding can lead to variance in people's practice of using TW/CW, and the discrepancy results in traumatic experiences for the vulnerable. In this research, we aim to investigate online users' perceptions of TW and CW on social media. We share our preliminary results from the semi-structured interview study (n=6) and present qualitative insights on social media users' perceptions of TW/CW. We found that our participants and those they interact with on social media try to empathize with other users through their use of TW/CW and other tools. However, there exists variation in people's understanding of TW/CW. We discovered that there also exist various norms and practices that people use in adding TW/CW. We then discuss the complexity of knowing when and how to add TW/CWs, and what social media platforms can do when TW/CWs are not perfect. Overall, we provide insights into people's understanding of TW/CW which can be used to inform the design of tools/features that social media platforms can incorporate. We conclude with our future plan to extend the study and motivate interventions that can empower social media users to make online space safer for the vulnerable.

Programmable Curli Nanofibers as a Platform for Engineered Living Materials

Authors: Hoda Hammad

Presenter: Hoda Hammad | *Poster presentation*

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Innovation in material sciences has been the primary driver of major changes in human history. Over the course of evolution, living cells -unicellular or multi-cellular- have tailored their pathways synthesizing complex materials responding to different environmental stimuli. Autonomous growth, self-organization, self-repair, responsiveness, and other characteristics of these living systems opened a different paradigm right at the interface between material science and biological engineering. Inspired by nature and living systems, synthetic biology aims at using biological systems to perform user-defined functions. Through genetic engineering, synthetic biology extended its impact into material science. Living cells have been utilized as bio-factories producing programmable materials tailored to biotechnological applications ranging from biomedical to agriculture fields. Incorporation of the engineered living cells into materials enabled novel functionalities such as self-healing, autonomous assembly, adaptivity, and self-regeneration that synthetic materials lack. Therefore, synthetic biology paved the way for active, dynamic, and functional biomaterials. Our advanced understanding of bacterial systems highlighted them as an ideal chassis for pioneering the living materials field. Majority of the bacteria, inherently, exists as biofilms endorsed in an extracellular matrix composed of polysaccharides, proteins, nucleic acids, and other biomolecules. The ability of bacterial biofilms to self-assemble into higher order structures have made them an attractive programmable platform for engineered living materials (ELMs). The current knowledge of genetic tools on model organisms such as E. coli made it an ideal organism for genetic prototyping in the field of ELMs. We will discuss different engineering techniques and synthetic biology tools that leveraged the power of the native curli system – the primary structural protein component of the E. coli biofilm – as a protein scaffold in different ELMs applications.

A large-scale drug screen identifies novel therapeutics for the syphilis pathogen, Treponema pallidum

Authors: Kathryn Hayes

Presenter: Kathryn Hayes | Poster presentation

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Since its discovery, penicillin has been the primary treatment option for syphilis, caused by the spirochete Treponema pallidum. Its efficacy against the pathogen is significantly greater compared to doxycycline, the only other viable treatment option thus far. Due to previous inability to culture T. pallidum in vitro, efforts to identify compounds that rival the efficacy of penicillin have been hindered. With up to 10% of the global population reporting penicillin allergies, global penicillin shortages, and growing concern about antibiotic resistance, alternative treatment options are needed. In this study a novel drug screen of almost 100 B-lactams was performed to determine their efficacy against T. pallidum in vitro. A multiphase, iterative approach of manual enumeration and qRT-PCR was used to identify a small subset of high preforming compounds. The top 10% of compounds were further evaluated to determine their in vitro minimum inhibitory concentration (MIC). Finally, we used a fluorescent D-amino acid to visualize peptidoglycan synthesis in drug treated and untreated controls to validate the efficacy of the antibiotics on a cellular level. We identified multiple B-lactams with similar or lower in vitro MICs compared to benzathine penicillin G, the current standard of care. Of note, was nafcillin which had an in vitro MIC of 0.553 ng/mL and had several additional promising characteristics such as a long half-life, low cost:efficacy ratio, and its current use in clinical settings treating penicillin resistant bacteria. Additionally, we determined that T. pallidum incorporates peptidoglycan ubiquitously across the sacculus indicating a lateral mechanism of growth. All of the top performing antibiotics caused a decrease in peptidoglycan remodeling and growth. This is the first major drug screen conducted for the syphilis agent and was successful in identifying several potential therapeutics for future clinical investigation. In addition, this work provides new insights into T. pallidum peptidoglycan biology.

The role of glial inflammatory mediators on neural dysregulation induced by SARS-CoV-2 infection

Authors: Brittany Heath, Kylene Kehn-Hall

Presenter: Brittany Heath | Poster presentation

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Neurological effects due to post-acute sequalae of SARS-CoV-2 infection (neuro-PASC) will impact public health spanning decades. Alterations in the central nervous system have been observed in a subset of COVID-19 patients presenting with neurologic manifestations akin to Alzheimer's Disease and Parkinson's Disease. Millions of people worldwide are currently affected by a neurodegenerative disease with the number of cases expected to rise. The causal relationship of COVID-19 and neurodegenerative diseases remain to be determined, yet it is critical to identify the mechanisms of neural dysfunction due to neuro-PASC. To address this gap, we aim to identify pathways in which SARS-CoV-2 infection leads to glial activation and subsequent neuronal injury and/or death. Here, we tested the direct infection of human astrocytes, microglia, and neuroblastoma cells by SARS-CoV-2. The release of infectious virus, absolute quantification of viral RNA, and fold changes in gene expression were measured. Astrocytes infected with SARS-CoV-2, maintained constant viral titers and intracellular viral RNA up to 48 hours post-infection (hpi). In contrast, microglia rapidly cleared SARS-CoV-2 infectious virus at 48hpi and intracellular viral RNA decreased at 24hpi. Next, we pre-screened cellular RNA for three markers of inflammation using RT-qPCR. CXCL10, IL1, and IL6 were chosen due to the elevated circulating cytokines in patient serum, and correlation with disease severity and clinical prognosis in COVID-19 patients. In astrocytes, increased expression of CXCL10 and IL6 was observed at 9hpi and 24hpi, respectively. Microglia exhibited significant upregulation of CXCL10 at 72hpi in absence of infectious virus. Direct infection of neuroblastoma cells with SARS-CoV-2 did not impact cell viability as determined by CellTiter-Glo. Our findings validate SARS-CoV-2 can modulate glial activity in the absence of infectious virus. Ongoing studies aim to identify secreted inflammatory markers from SARS-CoV-2 infected glial cells and their relation to neuronal viability as determined by multiplex ELISA and CellTiter-Glo.

Persistence of sarcocystis neurona, and histopathologic changes in horses with EPM

Authors: Lauren Helber, Alayna N. Hay, Bettina Wagner, Caroline M. Leeth, Tanya LeRoith, Thomas E. Cecere, Kevin K. Lahmers, Frank M. Andrews, Stephen R. Werre, Amy L. Johnson, Carol K. Clark, Nicola Pusterla, Stephen M. Reed, David S. Lindsay, Sandra D. Taylor, Krista E. Estell, Martin Furr, Robert J. Mackay, Fabio Del Piero, Mariano Carossino, Sharon G. Witonsky

Presenter: Lauren Helber | *Oral presentation*

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Neurological effects due to post-acute sequalae of SARS-CoV-2 infection (neuro-PASC) will impact public health spanning decades. Alterations in the central nervous system have been observed in a subset of COVID-19 patients presenting with neurologic manifestations akin to Alzheimer's Disease and Parkinson's Disease. Millions of people worldwide are currently affected by a neurodegenerative disease with the number of cases expected to rise. The causal relationship of COVID-19 and neurodegenerative diseases remain to be determined, yet it is critical to identify the mechanisms of neural dysfunction due to neuro-PASC. To address this gap, we aim to identify pathways in which SARS-CoV-2 infection leads to glial activation and subsequent neuronal injury and/or death. Here, we tested the direct infection of human astrocytes, microglia, and neuroblastoma cells by SARS-CoV-2. The release of infectious virus, absolute quantification of viral RNA, and fold changes in gene expression were measured. Astrocytes infected with SARS-CoV-2, maintained constant viral titers and intracellular viral RNA up to 48 hours post-infection (hpi). In contrast, microglia rapidly cleared SARS-CoV-2 infectious virus at 48hpi and intracellular viral RNA decreased at 24hpi. Next, we pre-screened cellular RNA for three markers of inflammation using RT-qPCR. CXCL10, IL1, and IL6 were chosen due to the elevated circulating cytokines in patient serum, and correlation with disease severity and clinical prognosis in COVID-19 patients. In astrocytes, increased expression of CXCL10 and IL6 was observed at 9hpi and 24hpi, respectively. Microglia exhibited significant upregulation of CXCL10 at 72hpi in absence of infectious virus. Direct infection of neuroblastoma cells with SARS-CoV-2 did not impact cell viability as determined by CellTiter-Glo. Our findings validate SARS-CoV-2 can modulate glial activity in the absence of infectious virus. Ongoing studies aim to identify secreted inflammatory markers from SARS-CoV-2 infected glial cells and their relation to neuronal viability as determined by multiplex ELISA and CellTiter-Glo.

Temperature dependent conditional expression of the Aedes aegypti male determining factor for efficient production of males in mosquito population control

Authors: Melanie Hempel

Presenter: Melanie Hempel | Poster presentation

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Aedes aegypti female mosquitos are responsible for the spread of multiple arboviruses causing deadly diseases such as Zika, dengue, yellow fever, and chikungunya. Effective treatments and vaccines are nonexistent or hindered by inadequate supply and misinformation. Current methods preventing the spread of disease primarily include controlling mosquito populations using insecticides, however rising insecticide resistance threatens the method's efficacy. Genetic control strategies such as sterile insect technique (SIT) and incompatible insect technique (IIT) are promising methods of A. aegypti population suppression via release of infertile male mosquitos. However, current methods of rearing mosquitos to obtain infertile males are expensive, laborious bottlenecks in these programs. Thus, it is crucial to develop innovative and effective methods for sex separation. Recently, the male-determining factor of A. aegypti was identified as a gene called Nix. NIX expression in genotypic females is enough for conversion to fertile, albeit flightless, males. We computationally determined residues in the NIX protein most likely to confer heat sensitivity when mutated, and successfully created two A. aegypti lines that demonstrate heat sensitive expression of NIX (HSNix). We established a line of mosquitos where both male and female genotypes contained HSNix and by changing the rearing temperature we can manipulate sex determination in the genetic females by conditional expression. When reared at 25 °C, only males were observed, indicating HSNIX was functional in genotypic females and caused conversion of females to flightless males. When reared at 32 °C, a small number of females were found, indicating the function of HSNIX at the restrictive temperature was, to some extent, affected by the mutation, allowing the production of homozygous HSNix lines. These lines can be used to rear all-males in the laboratory by only changing the rearing temperature, creating an effective and simple method of all-male production for programs such as SIT and IIT.

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

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Presenter: Claudia Hilton | *Poster presentation*

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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 71.4% of passengers followed a driver’s kind remarks with a “Thank You,” those passengers exiting after this passenger were less likely to express gratitude, supporting diffusion of responsibility over modeling or observational learning. Observations are ongoing and additional findings will be reported.

Interpersonal Impact of Diffusion of Responsibility: Behavioral Observations of Pedestrians Using Campus Crosswalks

Authors: Loralee Hoffer, Nicole Lydic, Naomi Harvey, Mikey Harrigan, E. Scott Geller

Presenter: Loralee Hoffer | Poster presentation

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This behavioral science study evaluated contrary predictions of two prevalent theories of psychological science: social modeling versus diffusion of responsibility. Specifically, this research observed whether pedestrians wave a sign of gratitude to drivers of vehicles who stop for them at designated crosswalks. Social modeling predicts that when a person waves at a driver for stopping, those walking behind that pedestrian are likely to wave an expression of gratitude as a function of observational learning or social modeling. However, diffusion of responsibility predicts that after the first person waves, those who follow behind are less likely to wave because they feel the first person took responsibility for the entire group. Trained observers sat unobtrusively adjacent to designated crosswalks and observed 36,882 pedestrians over 12 consecutive weeks, recording how many pedestrians waved a sign of gratitude, and the order in which more than one crossed the road. The results showed that the first person in a group was much more likely to wave (21.8%), compared to the second (7.13%), third (4.81%), and more pedestrians. This decline in gratitude expressions as the groups increased in size indicates that diffusion of responsibility had a greater effect than social modeling. As the group size increased, pedestrians were less likely to wave, presumably because they felt less obligated to express gratitude because someone else already did that. These results imply a need for interventions to increase interpersonal expressions of gratitude, even between pedestrians and the drivers who stopped for them.

Incidence of per- and polyfluoroalkyl substances (PFAS) in private water supplies in Southwest Virginia

Authors: Kathleen Hohweiler, Leigh-Anne Krometis, Erin Ling, Kang Xia

Presenter: Kathleen Hohweiler | Poster presentation

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Per- and polyfluoroalkyl substances (PFAS) are a class of anthropogenic contaminants of increasing human health concern due to their resistance to degradation, widespread occurrence in the environment, bioaccumulation in human and animal organ tissue, and potential negative health impacts. Drinking water is suspected to be a primary source of human PFAS exposure, so the US Environmental Protection Agency (EPA) has set aggressive interim and final health advisories for several PFAS species that apply to municipal water supplies. However, private drinking water supplies may be uniquely vulnerable to PFAS contamination, as these systems are not subject to EPA regulation and often include limited treatment prior to use for drinking or cooking. The goal of this study is to determine the incidence of PFAS contamination in private drinking water supplies in two counties in Southwest Virginia, and to examine the potential for reliance on citizen-science based strategies for sample collection in subsequent broader efforts. Samples for metals, bacteria, and PFAS analysis were collected on separate occasions by homeowners and experts at the home drinking water point of use (POU) for comparison. Reportable concentrations of at least one PFAS chemical were detected in 76% of samples collected, with an average total PFAS concentration of 6.91 parts per trillion (ppt). PFOA and PFOS, which are currently included in EPA health advisories, were detected in 13% and 11% of samples, respectively. Of the 30 PFAS species targeted, 14 were detected in at least one sample. On average, a single sample contained approximately 3 unique PFAS, and one sample contained as many as 8 different species. There was no significant difference in total PFAS concentrations between homeowner and expert collected samples (Wilcoxon, alpha = 0.05), which suggests that with proper training and instruction, homeowners will be able to collect their samples for analysis in future PFAS studies.

Circadian gene expression patterns in healthy and Idiopathic Pulmonary Fibrosis (IPF)-diseased human lung fibroblasts

Authors: Seun Imani

Presenter: Seun Imani | Poster presentation

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Idiopathic Pulmonary Fibrosis (IPF) is a chronic and progressive lung disease with a median survival of 3-5 years. IPF is characterized by irreversible fibrosis and scarring of the lung parenchyma, causing respiratory failure and death. Symptoms of IPF are dyspnea and decreased lung function, however, IPF patients markedly suffer from poor sleep quality, which correlates with the disease's severity. The circadian clock controls the sleep/wake cycle and gates major physiological processes like cell proliferation and inflammation. Circadian disruption has been linked to cancers and cardiopulmonary diseases. Data suggest a link between circadian rhythm and major events in IPF pathology, however, the mechanism is still unidentified. We hypothesize that core clock gene expressions and rhythmicity are disrupted in IPF fibroblasts. To test this, we seeded fibroblasts from Normal human Lung (NHLF) and IPF patients in 35cm dish plates and synchronized the circadian rhythms of the cells with dexamethasone. We then collected cell samples every 4 hours for 48 hours (for each timepoint, n=6 for NHLF and n=3 for IPF). We used Reverse Transcription-Quantitative Polymerase Chain Reaction (RT-qPCR) to evaluate the mRNA expression of 8 clock genes (Per1, Per2, Per3, Cry1, Cry2, Clock, Bmal1, and Reverb-) and Interleukin-6 (IL-6). Cosinor.online was used to generate cosine fit waves and rhythmicity was validated by JTL and Biodare2. P-values were corrected using the Benjamini-Hochberg procedure. Our findings showed that some of the clock gene transcripts had disrupted rhythmicity in lung fibroblasts from IPF patients, with different oscillations (phases and amplitudes). Interestingly, IL-6 rhythmicity was also markedly disrupted in IPF cells with mRNA peaking zeitgeber time (ZT) 3 hours earlier than in NHLF. This data suggests a circadian clock desynchronization in IPF. This is the first study to report timepoint clock gene transcript expression patterns in human healthy and IPF-diseased human lung fibroblasts.

Starting a flame without a fire: Using ultrashort electric shocks to promote cancer destroying inflammation

Authors: Khan Mohammad Imran, R.M. Brock, N. Alinezhadbalalami, K.N. Aycock, B. Tintera, H.A. Morrison, R.V. Davalos, I.C. Allen

Presenter: Khan Mohammad Imran | *Poster presentation*

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Pancreatic cancer is one of the deadliest diagnoses leaving patients with few therapeutic options. Traditional (Chemotherapy, radiotherapy) and recent targeted immunotherapy are ineffective against pancreatic cancer. Novel treatment modality is direly needed to improve patient outcome. Irreversible electroporation (IRE), a novel nonthermal ablation system, utilizes very short, high voltage electrical pulses to form micropores in cell membranes and stimulate cell death. We hypothesized that IRE could create electric shock wounds inside tumor and start tumor destroying inflammation by changing the surrounding tumor environment. We have utilized mouse pancreatic cancer model and measured tumor burden reduction and other markers to confirm our hypothesis. Our data showed that IRE treatment can kill cancer cells in vitro and causes necrosis (cell death) in vivo. We have also found that IRE treatment significantly reduces tumor burden (reduces tumor size or stop tumor growth) compared to untreated control. Since IRE destroys tumor cells that releases tumor cells' parts and particles into the system, the body's defense mechanism can detect it and destroy the source. Next, we sought to find out what kind cells of the immune system is being activated after IRE treatment. We have found that a kind of immune system cells called cytotoxic T-cells designed to destroy harmful cells in body increases in number near tumor after IRE treatment. To confirm even more we analyzed a marker of cytotoxic T-cell recruitment in tumor cells called interferon gamma (IFN) and found that IFN goes up in blood after 3 days post-IRE treatment. Finally, a long term survival study shows that IRE treatment increases progression free survival for 25 days in mice which is compared to 3 human years. In conclusion, our findings need to be tested in clinical trials so this technology can be used to treat human patients.

Spatiotemporal Estimations of Temperature Rise During Electroporation Treatments using a Deep Neural Network

Authors: Edward Jacobs IV, Sabrina Campelo, Kenneth Aycock, Daphne Yao, Rafael V. Davalos

Presenter: Edward Jacobs IV | Poster presentation

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The nonthermal mechanism for irreversible electroporation has been paramount for treating tumors and cardiac tissue in anatomically sensitive areas, where there is concern about damage to nearby bowels, ducts, blood vessels, or nerves. However, Joule heating still occurs as a secondary effect of applying an electric field through a resistive tissue and must be minimized to maintain these benefits at high voltages. Numerous thermal mitigation protocols have been proposed to minimize temperature rise, but intraoperative temperature monitoring is still needed. We show that an accurate and robust temperature prediction AI model can be developed using estimated tissue properties (bulk and dynamic conductivity), known geometric properties (probe spacing), and easily measurable treatment parameters (applied voltage, current, and pulse number). We develop the AI on realistic 2-D finite element model simulations with conditions encompassing most electroporation applications. Calculating feature contributions, we found that temperature prediction is mostly dependent on current and pulse number and show that the model remains accurate when incorrect tissue properties are intentionally used for the model input parameters. Lastly, we show that the model can accurately predict temperature rise within an ex vivo perfused porcine liver, with error <0.5C between the predicted and measured temperatures. This model, using easily acquired parameters, is shown to predict temperature rise in over 1,000 unique test conditions with <1C error and no observable outliers. We believe the use of simple, readily available input parameters would allow this model to be incorporated in many already available electroporation systems for real-time temperature estimations.

Creation of epitope-tagged Venezuelan equine encephalitis virus clones to delineate virus-host interactions

Authors: Abdullahi Jamiu, Ivan Akhrymuk, Kenneth Foreman, Dmitri Klimov, Mikell Paige, Kylene Kehn-Hall

Presenter: Abdullahi Jamiu | *Poster presentation*

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Venezuelan equine encephalitis virus (VEEV) is a mosquito-borne RNA virus that belongs to the genus Alphavirus. VEEV is a zoonotic virus that can infect both equines and humans. In humans, VEEV infection can progress to severe neurological complications in up to 14% cases. This virus is considered a potential bioweapon due to its ease of manipulation and aerosolization. Yet, no FDA-approved therapeutics or vaccines against VEEV currently exist for human use. VEEV, like many other viruses, can hijack host's machineries to facilitate establishment of infection. The VEEV capsid protein plays an important role in VEEV pathogenesis. The capsid can simultaneously bind with the host's nuclear import proteins, importin α/β1, and the host export protein, CRM1 to form a tetrameric complex. This complex prevents the transport of materials between the host's cytoplasm and nucleus, which result in the inhibition of host's antiviral response, and ultimately host's cell death. Moreover, VEEV TC83 Cm, with a mutated, non-functional nuclear localization sequence within the capsid, failed to inhibit host's antiviral response and couldn't cause disease in mice. Based on this, we hypothesized that chemical inhibitors capable of disrupting the interaction of capsid with importin α should increase the host's antiviral response, impact VEEV replication, and rescue host's cells from VEEV-induced cell death. Two small molecule inhibitors, I2 and 1564, were designed to disrupt this interaction. In order to evaluate the impact of these compounds on capsid-importin α interaction, we have successfully designed two clones of VEEV (TC83 V5-C and TC83 V5-Cm) that contain a V5-tag on the capsid. The V5-tag will promote easy detection of the capsid. The replication of these new viruses was similar to that of parental TC83 and TC83 Cm. Future studies will involve evaluating the impact of these compounds on capsid-importin interaction and capsid localization using co-immunoprecipitation and confocal microscopy.

Moms Are At the Heart of Emotion Regulation: Maternal Personality as a Predictor of Adolescent RSA

Authors: Jennifer J. Phillips, Martha Ann Bell

Presenter: Jennifer Phillips | Poster presentation

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Adaptive strategies for emotion regulation (ER) during adolescence protect against detrimental developmental outcomes (Cracco et al., 2017). Maternal factors, such as personality, play a role in helping adolescents develop adaptive ER strategies (Prinzie et al., 2009). The purpose of our study was to examine how maternal personality longitudinally and concurrently predicts adolescent ER, both independently and interactively. Mothers (n = 123) self-reported on their own personality when their children were in middle childhood and adolescence. ER was assessed via reactive respiratory sinus arrhythmia (RSA) in adolescents during tasks designed to evoke different ER strategies- cognitive reappraisal (CR), an adaptive strategy, and emotion suppression (ES), a maladaptive strategy. RSA is a biological influence on ER that examines the variability in heart rate linked to respiration, with higher reactivity scores indicating poorer ER (Beauchaine, 2015). Two hierarchical regression models were used, with adolescent ES RSA reactivity as the outcome in one and adolescent CR RSA reactivity as the outcome in the other. Step 1 of each model controlled for child RSA when children were in middle childhood, Step 2 included maternal temperament, Step 3 included maternal personality functioning, and Step 4 included interaction terms between maternal temperament and personality. Maternal personality functioning and temperament traits independently predict adolescent CR, with high levels of maternal surgency (extraversion; B = -0.34, p = .004) and maternal personality dysfunction (B = -0.27, p = .009) independently predicting adolescent CR. However, maternal personality dysfunction moderated the association between maternal surgency and adolescent ES, at the 10% level, so that higher levels of maternal surgency predicted less use of ES, but only when mothers were low in personality dysfunction (B = -0.25, p = .06). These results highlight that maternal personality plays differential roles in adolescent ER, depending on the strategy in question

Violence and food choices: Reading the plight of Indian socio-religious minorities and caste subalterns

Authors: Trevor Jeyaraj, Wencylaus Mendes

Presenter: Trevor Jeyraj | Oral presentation

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This presentation aims to shed light on the loaded socio-political meanings and implications of food practices of minoritarian socio-religious and social-caste groups in India. That is, they (we) are prevented from practicing their/our food choices with freedom and in peace, a freedom and basic right that is offered for the majoritarian socioreligious group. That is, the talk by bringing in real-time perspectives of violence surrounding beef-eating aims to critique/interrogate the fetishization of the continued orientalist perceptions of the Indian subcontinent as a land of Vegan practices and the portrayal of non-violence towards every human being. Such a 'harmless' perception, the presentation will shed light on, erases the plight of violence upon millions of Indian religious minority citizens' by robbing us of our basic right to practice our food choice/s in peace. This presentation aims to foreground the voices of the Indian religious subaltern (aka the voice-denied/suppressed citizen) which in turn can critique the assumptions that drive this ideology of the gastronomical site as a space devoid of socio-political meanings and implications. Such assumptions the presentation argues can be quite harmful for the subaltern folks' livelihood and their very life survival (caste and religious minorities in particular), in other words, death is not far away if we/they dare to eat beef. Through the presentation, it is the aim of the presenters, as citizens from the Global South, to shed light on the plight of minorities' continuing struggle for basic rights.

Drag reduction by the injection of polymeric additive solutions into the flow-stream

Authors: Jorge A. Clares Pastrana

Presenter: Jorge A. Clares Pastrana | *Poster presentation*

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Lower emission marine transport vessels are what lie ahead in the next decade. Like the automobile industry, the maritime industry will need to adapt to the environmental challenges that today's modern world pose. The increased demand for a more efficient supply chain requires a more economical and environmentally friendly solution. Feasible drag-reducing techniques are crucial research areas that have received much attention in the past years. Drag reduction by the injection of polymer additives with viscoelastic characteristics is one of the drags reducing methods that show the most potential to date. Polymer injection into the boundary layer can successfully reduce drag by 80 percent, consequently cutting costs and emissions. This dissertation presents an experimental approach to injecting polymer additives that maximize drag reduction. We investigate, test, and compare different polymer additives, at various injection angles, with distinct hydration processes at unique concentrations, which, when combined, result in the best possible polymer additive solution to inject into the flow to guarantee minimum drag, resulting in minimum costs and emissions.

SARS-CoV-2 rapidly infects peripheral and central nervous system neurons preceding viremia, facilitated by the cell membrane protein neuroplin-1

Authors: Jonathan D. Joyce, Greyson A. Moore, Poorna Goswami, Telvin Harrell, Tina M Taylor, Seth A. Hawks, Jillian C. Green, Mo Jia, Neeharika Yallayi, Emma H. Leslie, Nisha K. Duggal, Christopher K. Thompson, Andrea S. Bertke

Presenter: Jonathan D. Joyce | *Poster presentation*

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Approximately 80% of patients with acute COVID-19 and 85% with “long COVID” report neurological symptoms. Detection of SARS-CoV-2 in cerebrospinal fluid and brains of COVID-19 patients indicates it is neuroinvasive. Although studies have focused on the ability of SARS-CoV-2 to invade the central nervous system (CNS) through neurons responsible for smell, little attention has been paid to infection of the peripheral nervous system (PNS) or other neural pathways. Additionally, the role of direct vs bloodborne neural entry, viral replication dynamics in neurons, and alternative viral receptors remains unassessed. To assess the ability of SARS-CoV-2 to infect the PNS and to determine the role of neuronal vs bloodborne entry, we intranasally infected mice expressing the SARSCoV-2 receptor ACE2 (K18-hACE2), wild-type mice (WT), and hamsters with SARS-CoV-2. PNS tissues, brain regions, whole brain hemispheres, and spinal cord samples were collected 18-, 42-hrs, three-, and six-days post infection. Viral RNA was detected using RT-qPCR, protein and genome via immunostaining, and infectious virus via plaque assay. Viral RNA, protein, and infectious virus was found in PNS, spinal cord, and brain regions as early as 18 hours post infection, preceding viremia. Primary neuronal cultures from K18-hACE2 and WT mice were infected and assessed as above to determine SARS-CoV-2 replication kinetics. Viral RNA increased over time in a neuron dependent manner, indicating replication. When neuronal cultures were pretreated with a neuropilin-1 (NRP-1) antagonist before infection, viral RNA was reduced by 99.8% and 86.7% in hACE2 and WT neurons, respectively. We show that the PNS, discrete brain regions, and spinal cord are permissive to infection, that neuroinvasion occurs rapidly via direct neuronal entry preceding viremia, and that entry involves NRP-1. Invasion of these tissues may contribute to neurological symptoms of COVID-19/”long COVID” and merit further investigation as COVID-19 transitions from a pandemic disease to an endemic disease.

Agroforestry with Refugees and Hosts in Northwestern Uganda

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Presenter: Sarah Juster | *Poster presentation*

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Steep population increases in refugee-hosting northwestern Uganda are associated with significant regional deforestation, with important consequences including the disruption of local ecosystems, soil erosion and the loss of tree products such as fruits, medicine, timber, and fuelwood. Since 2018, World Agroforestry (CIFOR-ICRAF) has promoted agroforestry—the intentional integration of trees and crops—with South Sudanese refugees and Ugandan hosts in the Imvepi and Rhino Camp refugee settlements of northwest Uganda. The goals of CIFORICRAF programming are environmental restoration and human welfare improvement. Evaluative data on CIFOR-ICRAF's progress has been sparse. The objectives of this research are to study 1) CIFOR-ICRAF impacts on environmental restoration, 2) CIFOR-ICRAF impacts on participant human welfare, and 3) participant recommendations for future directions of CIFOR-ICRAF programming. Interviews were conducted with 80 refugee and host community households and outcomes compared between households with less than one year of agroforestry participation and those with one year or more. Refugee households with longer CIFOR-ICRAF involvement were found to have 22 more trees per plot than households with less involvement. Increased duration of CIFOR-ICRAF involvement is strongly associated with reduced off-plot fuelwood harvesting, potentially lowering pressure on surrounding vegetation. Refugees are planting a variety of native and non-native tree species, contributing to biodiversity preservation. Small improvements to household income demonstrate human welfare gains from tree planting, as does reduced childhood food insecurity through consumption of household tree fruits. Women reportedly manage agroforestry activities in 76% of refugee and 42% of host national households. Program recommendations by refugee and host respondents include increased agroforestry training, treeplanting groups for women, and rewards for successfully grown seedlings. Programming impacts are most hindered by low seedling survival rates. The results suggest that, despite challenges, CIFOR-ICRAF is contributing to landscape-level environmental restoration and human welfare improvements among participants.

Game of Proteins: How EphA4 and Tie2 Battle to Control Blood Vessel Growth After Stroke

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Presenter: Alexandra M. Kaloss | *Oral presentation*

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Strokes are a leading cause of death and disability worldwide, with the majority of cases being ischemic strokes, where a blood clot blocks blood flow to the brain. Without the critical oxygen and nutrients that the blood provides, cells in the affected region of the brain begin to rapidly die, leading to neurological deficits. While current treatments focus on removing the clot, it does not guarantee that blood flow will return to the damaged area. Instead of removing the clot, our research focuses on pre-existing blood vessels in the brain, called pial collaterals, that can ease the loss of blood flow after stroke. While they do little under healthy conditions, after a stroke these blood vessels can enlarge to reroute blood flow to the injured tissue. Thus, pial collateral growth is a critical process in the initial hours after stroke when this blood flow can prevent brain cells from dying. Our previous work has shown that mice lacking the EphA4 protein have significantly larger pial collateral vessels and reduced tissue death, suggesting that this protein limits vessel growth. We hypothesize that one of the primary ways EphA4 prevents vessel enlargement is by inhibiting Tie2, a protein involved in blood vessel stability and growth. To test this, we gave a Tie2 activating drug (Vasculotide) after stroke to determine if artificially stimulating this pathway would prevent the negative effects caused by EphA4. After a stroke, mice that received Vasculotide had significantly larger pial collateral vessels at 1-day than control mice. Additionally, Vasculotide treated mice had significantly less damaged tissue 1-day post-stroke and performed better on behavioral tests assessing motor function than control mice. Therefore, inhibiting EphA4 or stimulating Tie2 may be novel therapeutic targets for expanding pial collateral blood vessels and returning critical blood back to injured areas of the brain.

Elucidating the pathophysiological changes that occur after brain injury to increase the likelihood of developing Parkinson's disease

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Presenter: Colin Kelly | *Poster presentation*

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Parkinson's disease (PD) is the most common motor deteriorating neurodegenerative disease. In a recent study following a large cohort of over 300,000 military veterans, individuals that had sustained a mild traumatic brain injury (TBI) saw a 56% increased risk of developing PD later in life. However, the mechanisms by which TBI increases this risk remain unknown. Neuroinflammatory events triggered by TBI are of particular interest because PD post-mortem brains have Lewy body (LB) aggregates (insoluble, misfolded proteins) that accumulate in dopaminergic neurons and, additionally, show signs of neuroinflammation. α-synuclein is the protein implicated in PD pathology and has been shown to induce the formation of those LBs. LB aggregation results in the death of these neurons in interconnected brain regions. Using a well-established model of PD that involves either the treatment of fibrillar α-synuclein proteins to neurons in culture or the injection of the protein directly into the brain tissue, we can generate PD-like LB pathology experimentally. Previously, we replicated LB pathology in primary neuronal cultures using this model and reported that primary neurons that received the treatment activated an innate immune response as soon as 5 days post treatment. Now, in mice, we have generated a closed skull, moderate controlled cortical impact (CCI) injury that best replicates a mild traumatic brain injury (mTBI), and confirmed that this model displays blood brain barrier (BBB) breakdown and immune cell infiltration patterns seen in humans. Using this mTBI mouse model in addition to our injection-induced model of PD, we are testing whether TBI-induced neuroinflammation earlier in life can accelerate the spread and development of PD-like LB pathology and neuronal cell death, and have begun experiments to identify a mechanism that addresses these findings.

Equine bone marrow-derived mesenchymal stromal cells disrupt the matrix of established orthopedic biofilms in vitro

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Presenter: Sarah Khatibzadeh | *Oral presentation*

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Biofilms protect bacterial infections from being killed by antibiotics, thereby causing complications and mortality in horses with orthopedic infections. Equine bone marrow-derived mesenchymal stromal cells (MSC) kill free-floating bacteria but their ability to disrupt biofilms is unknown. Our objective was to evaluate the ability of MSC to reduce S. aureus or E. coli biofilms in vitro. We hypothesized that MSC would reduce biofilm matrix and live bacterial colony-forming units (CFU), and that MSC with an antibiotic, amikacin sulfate, would reduce these components more than MSC alone. MSC were cultured in antibiotic-free medium from bone marrow cells from 5 adult Thoroughbred horses. S. aureus or E. coli biofilms were established for 24 hours and then treated in triplicate for 24 or 48 hours in a transwell co-culture system: 1) untreated (negative) control; 2) 500 µg/mL amikacin and 2% sodium dodecyl sulfate (positive control); 3) 30 µg/mL amikacin; 4) 106 passage 3 MSC; 5) MSC with 30 µg/mL amikacin; 6) medium (contamination control). After treatment, biofilms were photographed, biomass quantified via crystal violet stain, and CFU quantified following enzymatic digestion. Data were compared using mixed model ANOVA with post-hoc Tukey comparisons ($p < 0.05$). Compared to untreated controls at both timepoints, S. aureus biofilm biomass was reduced by MSC ($P < 0.001$) and MSC with amikacin ($P < 0.001$). E. coli biofilm biomass was reduced by MSC with amikacin ($P < 0.05$). Compared to untreated controls, MSC reduced S. aureus CFU at 48 hours ($P < 0.05$) and MSC with amikacin reduced S. aureus ($P < 0.001$) and E. coli ($P < 0.001$) CFU at both timepoints. MSC-treated biofilms were smaller and less defined than untreated biofilms. MSC show promise as a treatment for equine orthopedic biofilm infections. Evaluation of biofilm-MSC interactions and effects of MSC dose and treatment time are warranted.

Colonization efficiency of novel drug-resistant Neisseria gonorrhoeae mutants in a gonococcal infection mouse model

Authors: Babatomiwa Kikiowo

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Gonorrhea, a sexually transmitted disease caused by Neisseria gonorrhoeae, is the second most common sexually transmitted bacterial infection in the United States. The increasing prevalence of N. gonorrhoeae infections has been due to the emergence of antimicrobial-resistant strains. Most seriously, this uprising resistance to all classes of antibiotics could lead to a future with untreatable gonorrhea. Thus, the development of novel anti-N. gonorrhoeae drugs is urgently needed. N. gonorrhoeae FA1090 is the only strain reported to be used for in vivo mouse models because of its natural resistance to streptomycin. Streptomycin is a necessary antibiotic utilized in the mouse model to inhibit the commensal flora in the lower genital tract of mice to enhance N. gonorrhoeae colonization. However, this strain is susceptible to all antibiotics used to treat gonorrhea, and therefore, it is not suitable for drug discovery. To test the efficacy of new therapeutics against clinically important N. gonorrhoeae isolates, such as ceftriaxone-resistant and azithromycin-resistant strains in vivo, streptomycin resistance is a required phenotype for performing the in vivo mouse model. Thus, there is a requirement to develop N. gonorrhoeae strains that are simultaneously resistant to streptomycin as well as standard-of-care antibiotics, azithromycin and ceftriaxone. In this study, using allelic-exchange procedures, we constructed a N. gonorrhoeae mutant that is resistant to both streptomycin and azithromycin, and another N. gonorrhoeae mutant that is resistant to both streptomycin and ceftriaxone. The minimum inhibitory concentrations of standard antibiotics were determined against the newly constructed strains compared to their wild-type strains. When used in N. gonorrhoeae genital tract infection mouse model, mice were colonized with the new mutants for 14 days similar to N. gonorrhoeae FA1090. Overall, our results indicate that the newly constructed mutants are suitable to be utilized in the N. gonorrhoeae infection mouse models for drug discovery studies.

Residential guidance to detect and address health and aesthetic concerns of elevated copper in drinking water

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Some residents have elevated levels of copper in their drinking water, causing aesthetic concerns like blue water, blue hair, fixture staining and occasional health concerns for humans and pets. The United States Environmental Protection Agency (EPA) Lead and Copper Rule (LCR) prioritizes sampling of older homes at greatest risk for elevated lead, neglecting new homes at highest risk for elevated copper. Moreover, residents with private wells are not regulated under the LCR. Consequently, residents with copper above the 1 mg/L EPA Secondary Maximum Contaminant Level need new approaches to address problems with elevated copper in drinking water. We examined how water quality criteria and citizen science can help residents address copper corrosion concerns. First, we developed a decision-making framework utilizing water quality criteria (pH, alkalinity, and orthophosphate) to classify waters as “low cuprosolvency.” Consumers with these waters can wait, with some confidence that their elevated copper will naturally decrease as pipes age and develop lower solubility scale layers over a period of weeks to months. Inputs to this framework can potentially be derived from low cost at home test kits, that empower consumers to diagnose their problems and consider possible solutions. If a water does not meet these criteria, interventions may be needed to reduce copper, including corrosion control (raising pH) or using filters (i.e., removing copper at point of use). “Low cuprosolvency” water quality criteria were identified using linear regressions ($R^2 > 0.98$) with threshold “minimum” pH’s as a function of alkalinity. Laboratory and citizen science testing of inexpensive at-home test kits for copper and pH demonstrated their accuracy, with good correlations observed between field and laboratory testing ($R^2 > 0.8$ for copper and liquid-based pH tests). Finally, citizen science field testing and companion laboratory studies supported a new framework to guide decision-making addressing copper corrosion concerns.

Genetically Engineered Wound Dressing for Sensing and Treating Candida albicans infectious in Diabetic Foot Ulcers

Authors: Anna Kurowski, Anna Duraj-Thatte

Presenter: Anna Kurowski | *Poster presentation*

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Diabetes mellitus is an epidemic condition that affects between 7.2-11.3% of individuals worldwide, with up to 34% of these individuals suffering from diabetic foot ulcers.1 In diabetic foot ulcers, Candida albicans is one of the most commonly found yeasts causing infection.2 Due to indiscriminate use of antibiotics in clinics, C. albicans is often left untreated, resulting in candidiasis, a condition where Candida has infected the inner tissue, which typically requires amputation. While existing treatments using azoles exist, there has been rising concern about antifungal resistance in Candida populations to these medicines, leaving a crucial need for fast, efficient ways to identify and treat this infection. 3 We have designed a smart antifungal hydrogel wound dressing that both treats Candida infections and utilizes genetically engineered bacteria to sense an active infection. Our lab currently utilizes functional proteinaceous nanofibers to develop functional living material. Through genetic engineering, we can display functional peptides or proteins on the bacterial protein unit CsgA that self-assembles to form functional nanofibers.4 Utilizing these engineered fibers, we can manufacture microbial hydrogels.5 In this design, we modify these fibers by grafting antifungal proteins to the proteinaceous nanofibers to develop an antifungal dressing to treat and sense diabetic candidiasis. The use of natural antifungal peptides/proteins reduces the risk of antifungal resistance strains from emerging and has less cytotoxic effects on mammalian cells compared to current fungal treatments. Embedded within this hydrogel dressing is a cell-based biosensor, which can produce fluorescent proteins when in contact with molecules produced by C. albicans during active infections, allowing for a simpler, faster, and more convenient method of identifying Candida infections than current conventional methods.

Arming Policy: Creating a Toolkit For Engaging with Nuclear Facilities in Armed Conflict

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Presenter: Clint Lanham | Poster presentation

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In the Nuclear Science, Technology, and Policy (NSTP) Certificate at Virginia Tech, students have the opportunity to collaborate in an interdisciplinary environment and work on contemporary global concerns. This project centers around the work performed in Fall 2022. Students from diverse academic backgrounds (the Team) worked on the recent concerns of Nuclear Facilities in Armed Conflict (NFAC). Through the course of this project, the Team was guided by Virginia Tech professors and interacted with subject matter experts in industry, government, policy and academia. The collaborative nature emulated realworld workshops and committees focused on providing recommendations through technical analysis. The Team was charged with investigating aspects of state-level military conflict around nuclear facilities. Overall, this project was designed to identify areas of neglect in, and possible avenues for policy makers to take, tackling the safe operation of NFAC. Through the course of this project, the Team had to tackle a blend of quantitative and qualitative arguments weighing aspects unique to the nuclear industry and its engagement with civilian populations. Specifically, the Team targeted technical and policy concerns surrounding current issues and past case studies. The recent occupation of Ukraine's nuclear power plant made headlines as unprecedented in the history of the nuclear industry. The Team refuted this "unprecedented" assertion through studying the historical record, as safety and security concerns from direct military incursion have occurred in the nuclear field. Another key product of the situation in Ukraine, is that the International Atomic Energy Agency (IAEA) has produced the "7 Pillars" to highlight concerns in Ukraine. The Team evaluated the 7 PIllars and their ability to act as a policy infrastructure in future discussions.

Inflammation influences the association between childhood maltreatment and adult depression in premenopausal women

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Presenter: Jasmine Lewis | Oral presentation

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Background. Individuals with a history of childhood maltreatment (i.e., physical, sexual and emotional abuse) are twice as likely to develop persistent and recurrent depressive symptoms in adulthood. The Social Signal Transduction Theory states that chronic stressors can be perceived by the brain and body as a threat, and will activate the hypothalamic-pituitary-adrenal axis and the immune system; over time, if this chronic stress continues, then inflammation increases leading to depression. Pro-inflammatory biomarkers such as interleukin-6 (IL-6) c-reactive protein (CRP), and tumor necrosis factor alpha (TNF-∝) have been linked to both childhood maltreatment and adult depression. Mood disorders such as depression are more commonly diagnosed in females than males. In addition, females report more incidents of childhood sexual and emotional abuse compared to males. Previous literature has suggested that hormonal changes in females (i.e., menstrual cycle, perimenopause, pregnancy, and puberty) make them susceptible to developing depression, as prevalence rates between males and females are equal both pre-puberty and post-menopause. As such, this study sought to examine the influence of IL-6, CRP and TNF-∝ on the association between childhood maltreatment and adult depression in premenopausal females.

Methods. Participants were taken from the Midlife in the United States Refresher Biomarker project conducted from 2012-2016. The sample consisted of 141 premenopausal females between the ages of 25-45 years (Mage=36.73).

Conclusion. Results showed that for women with higher levels of inflammation, as measured by IL-6 or TNF-∝, experiencing childhood abuse was more strongly associated with depression. Interestingly, for females with low levels of inflammation, childhood abuse was largely unrelated to depression symptoms. Findings suggest that treating inflammation in premenopausal women may help reduce risk for depression. Future studies should examine whether pregnancy status, menstrual cycle, or birth control use influence these associations.

FDA-approved drug library screening identifies the anti-inflammatory drug, auranofin, reveals antibacterial activity against Neisseria gonorrhoeae

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Neisseria gonorrhoeae, the second most common bacterial cause of sexually transmitted infections, is listed as an urgent-threat pathogen by the Centers for Disease Control and Prevention (CDC). Due to the growing prevalence of resistance development against the first-line treatment and several classes of antibiotics, the discovery of new anti-gonorrheal therapeutics is an urgent need. Drug repurposing is the process of discovering new therapeutic uses for existing drugs that go beyond the original medical indication, which significantly reduces the time and expense associated with traditional drug development. Herein, utilizing a drug repurposing approach, we screened 3,802 FDA-approved and clinical drugs against N. gonorrhoeae FA1090. A total of 14 novel non-antibiotic compounds were identified in the screening with significant anti-gonococcal activity. Auranofin, an FDA-approved antirheumatoid arthritis drug, was selected for further investigation due to its potent activity. A time-kill kinetics assay revealed that auranofin exhibited rapid bactericidal activity in vitro against N. gonorrhoeae, outperforming the drug of choice, azithromycin. Moreover, auranofin reduced the N. gonorrhoeae burden in a female murine model of vaginal infection by 91% and 96% after three and five days of treatment, respectively. In conclusion, our results indicate that auranofin merits further investigation for development as a future anti-gonorrheal therapeutic to replenish the dry pipeline of anti-gonorrhea medications.

The Origin of Architecture

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Presenter: Jenny Liao | *Oral presentation*

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While typing down these words, I am in my room under a roof. It seems that engaging with architecture is an inevitable part of our daily life. Thus, it is natural to ask why we start building in the first place. This study explores the root of architecture through origin stories written in five architectural treatises by Vitruvius, Alberti, Filarete, Palladio, and Laugier with a focus on architecture's relation to the world and human beings to reexamine the purpose of architecture through the lens of the Vita Activa proposed by political philosopher Hannah Arendt and to reflect on what architects are doing. Though various architects have depicted different origins of architecture, it is clear that three aspects promoted the desire for architecture: the necessity for survival, the need to dwell, and the desire for others, which closely correspond to the Vita Activa, three fundamental human activities that Arendt proposed: labor, work, and action. Architecture facilities our laboring activities, which corresponds to the biological process of the body, by providing shelters that are necessary for survival. It relates to our work, activities that associate with the unnaturalness of human existence, by securing the world of things among which humans dwells. Finally, architecture initiates action, an activity directly between people, by defining boundaries of the public realm and articulating space to fulfill desires for others. On the other hand, in the process of making architecture, all three activities are involved: people labor on constriction sites, architects work to design, and all parties action to communicate. Therefore, architecture is a profession that constantly engages with the Vita Activa and as a result, its creation, architecture facilitates that of others. Thus, it is crucial to think about what architects should do and what architects are doing.

The Role of Inflammation During the COVID-19 Pandemic: Dimensions of Early Maltreatment and Depression Symptoms

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Childhood adversity is associated with risk for depression during adolescence and young adulthood (Pagliaccio & Barch, 2016). Early adversity (e.g., abuse and neglect) may be associated with biological risk for depression through changes in immune functioning, such as inflammation (Reid & Danese, 2020). This study examined 1.) how inflammatory biomarkers mediate adverse experiences of abuse or neglect on depression symptoms and 2.) how depression symptoms mediate experiences of abuse and neglect on inflammation levels. Identifying mechanisms of adversity associated with depression and heightened inflammation may inform intervention efforts and prevent negative health outcomes. This is particularly important during the COVID-19 pandemic, when social, personal, and financial stress were heightened. The current study included 78 adolescents and young adults (53% male; 18 years old at Time 1) and were assessed annually for two years. The Maltreatment and Abuse Chronology of Exposure assessed maltreatment ages 1-18. Depression symptoms were assessed using Adult Self-Report. Salivary cytokine levels were used to assess inflammatory biomarker, C-Reactive Protein (CRP). Structural Equation Modeling (SEM) in Mplus, was used to examine direct and indirect effects in hypothesized models. There was a significant direct effect from CRP to depression symptoms ($\beta = .314$; $p = .001$) and from abuse to depression ($\beta = .295$; $p = .010$) during the pandemic; however, there were no significant indirect effects from adversity on depression through inflammation levels. Additionally, there were significant direct effects from experiences of abuse to depression symptoms before the pandemic ($\beta = .452$; $p = .000$) and from depression to heightened CRP during the pandemic ($\beta = .222$; $p = .026$). Indirect effects were significant, such that abuse predicted higher CRP via higher depression (95% CI: .00026 to .01387). The study elucidates pathways connecting early experiences of abuse, depression, and inflammation during the transition into young adulthood.

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

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Hokie for a Day is a field trip aimed at increasing college and career awareness among Title I student populations in rural, Appalachian county areas. This program includes hands-on activities 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. Since the VEF was originally developed for science centers and museums, there are few studies applying this framework outside of these environments. This study aims to explore the feasibility of applying VEF to an informal learning environment on a university campus. For hands-on activities, The VEF fits well into this setting due to the short amount of time students have with each exhibitor. Additionally, this method of assessing learning does not impede the student's potential learning opportunities nor does it require student participation or time. A team of faculty, graduate, and undergraduate student evaluators have used the VEF to record observational data over an academic semester. These evaluators applied Barriault's framework and observed behaviors associated with three categories to assess learning during Hokie for a Day exhibits. The team is employing code checking for credibility of data. Analysis of collected data is underway; however, preliminary results show that our data aligns with expected findings. 97% and 82% of students demonstrated learning behaviors consistent with Initiation and Transition respectively. A smaller number 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.

Interpersonal Gratitude and Subjective Well Being: Demonstrating functional control of a practical intervention

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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 our 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 8.61% of 15,124 pedestrians during Baseline, 10.31% of 25,993 pedestrians during the prompting intervention, and 6.11% of 60,764 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.

Why are we not winning our collective "War on Cancer" yet? Insights from organizational learning and capability building

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“I believe we can end cancer as we know it and even cure cancers once and for all”. President Joe Biden, September 12, 2022.

President Biden’s recent call to eradicate cancer comes as a renewal of his administration’s “Moonshot to Cure Cancer” on the 60th anniversary of President Kennedy’s famous moonshot speech. The renewed “Cancer Moonshot”, as the term “renewal” suggests, is not the first national effort to fight against cancer. Its history goes back to the National Cancer Act of 1971, informally known as “War on cancer”, during the Nixon administration. Since then, the large-scale effort to combat cancer has been renewed a handful of times, resulting in increased funding for cancer research. The increasing investments have brought about improvements in diagnosis, treatment, and survival of cancer patients; however, the progress in our collective “War on cancer” has slowed down and stalled in the past two decades, leaving milestones unachieved and cancer unyielding as a leading cause of death. The repeated “reignition” of these plans points to the sustained urgency of combating cancer, as well as the persistence of the problem. There is strong evidence demonstrating the saturation of return on investment in cancer research, as well as increasingly diverging innovation strategies among cancer research centers. This study seeks to investigate the contributing factors to differences among innovation strategies of cancer research centers and whether the slow-down in the outcomes of cancer treatment research is affected by these differences. Moreover, since the nature of cancer research centers’ activities demand learning and capability building and the trends of the centers’ innovation strategies suggest specialization over time, this study seeks to test if the cancer research centers’ innovation strategy is affected by learning from experience.

Linguistic Diversity as Predictor of Human Development in African Countries

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Presenter: John Marshal | *Oral presentation*

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The original clamor before the United Nations against colonization petitioned for "indigenous self-determination". Today's post-colonial states, especially in Africa, do not reflect that original vision of political autonomy for ethnic groups. The author wondered if human development levels would be higher across the African continent if indigenous groups were in charge of their political destiny. This study tested an index of language “fractionalization” for 42 African countries developed by Alesina et al, 2003) against the UNDP’s Inequality-adjusted Human Development Index (IHDI). After controlling for key variables. I found that up to 9 percent of a country’s human development index was attributed to its level of language diversity.

Grasshopper Applications to Identify the Impact of Window-toWall Ratio on EUI in Office Buildings in 6A Climate in the United States.

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The energy use intensity (EUI) of a building indicates its environmental impact and thermal comfort. The window-to-wall ratio (WWR) is a major factor impacting thermal energy transfer with the environment and thus the EUI. Office buildings account for over 50% of energy consumption in the U.S. This study investigates the effect of WWR on EUI, with a focus on demonstrating that WWR can independently control the entire EUI of office buildings, leading to reduced energy consumption.

The study investigates descriptive statistics for nine design alternatives on more than one model, such as the built environment, building orientation, height, and WWR. The study adds ASHRAE 90.1 and Energy Star to the formula in Grasshopper. Grasshopper is a powerful software that runs detailed EUI analysis using Honeybee, Ladybug, and Energy Plus simultaneously on the same script. The research tests six WWR alternatives on one model with five different orientation positions. It also investigates three more advanced models in detail to show the WWR effect on EUI, thermal comfort, and space temperature. Finally, the research compares the nine results to find which models met the Energy Star benchmark and how.

Energy modelers used to define WWR as one of many other factors that affect EUI. Contrary to what has been assumed, WWR is the primary driver in EUI reduction in cold climate zones. It can decrease the EUI of office buildings to 45% less energy consumption. Office buildings in the 6A climate zone can reach 27 KBTU/ FT less than usual. This study provides evidence that the WWR plays the most significant role in the EUI control in office buildings in the 6A climate. In conclusion, the WWR has a different effect on EUI in different climate zones because of the different heating demands.

Influence of Stink Bug Crop Damage on Edamame Bean Quality

Authors: Rebekah Miller, Susan Duncan, Thomas Kuhar, Kemper Sutton, Jacob Lahne, Bo Zhang, and Yun Yin

Presenter: Rebekah Miller | *Poster presentation*

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As a high value and nutritive crop, edamame (Glycine max (L.) Merr) can boost the income of famers of varying production capacities. A local supply of edamame is necessary for fresh market sales as the product shelf life is extremely short and often requires freezing for distribution. Stink bugs are a major pest concern for edamame as feeding on the pods during growing causes significant visual defects on the beans. This study evaluates possible flavor differences between edamame damaged and not damaged by stink bug feeding for two growing seasons (2020; 2021). Edamame was harvested and transported to the Virginia Tech Food Science Department for processing. Beans were then separated based on the presence of stink bug damage which was characterized by having a small gray or black dot or a large brown patch on the bean. Volatile analysis used headspace solid-phase microextraction followed by gas chromatography mass spectrometry (GC-MS) to identify volatile compounds present in the samples. Additionally, sensory evaluation comparing the damaged and not damaged beans was conducted to determine if panelists can identify the differences in samples. Volatile analysis results showed significant differences between stink bug damaged and not damaged edamame. Sensory evaluation indicated panelists were unable to tell a true difference between damaged and not damaged edamame. Enzymes from stink bug saliva may cause chemical conversion in edamame impacting volatile profiles as shown in the volatile results. However, panelists failed to detect any sensory differences between sample types. Therefore, visually inadequate edamame samples might not be appealing for consumption as whole beans but maybe well suited for use in processed food products where visual deficiency will be masked.

Non-essential role for Cx3cr1-expressing EPH receptor A4 in a murine model of TBI

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Presenter: Jatia Mills | *Poster presentation*

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Erythropoietin-producing human hepatocellular (Eph) receptors contribute significantly to central nervous system injury. Our findings demonstrated that Cx3cr1-expressing cells within the perilesional cortex showed increased levels of EphA4 after induction of controlled cortical impact (CCI) injury in mice. Cx3cr1 is a fractalkine receptor, commonly expressed on resident microglial and peripheral-derived macrophage (PDM) cells. The aim of this study is to identify the role of microglial-specific EphA4 in CCI-induced damage. Cx3cr1 CreER/EYFP knock-in/knock-out mice expressing EYFP in Cx3cr1+ cells were used to evaluate microglia in EphA4-deficient mice following 1-month tamoxifen injections. CCI-Injured wild-type (WT) Cx3cr1 CreER/EYFP /EphA4 +/+ mice displayed increased EphA4 expression on the EYFP-positive cx3cr1 cells within the peri-lesion. Immunohistochemical applications were further used to differentiate between the peripheral-derived macrophage and resident microglia using anti-Ccr2, which selectively labeled PDMs and not microglia. We then exploited GFP bone marrow chimeric mice to discriminate EphA4 expression on microglia (TMEM119+/GFP-) versus PDMs (GFP+) following CCI. Finally, the use of Cx3cr1 CreER/EYFP /EphA4 f/f (KO) mice, which show no detectable transcript for EphA4 in microglia only, demonstrated no discernible difference in lesion volume or blood brain barrier (BBB) disruption when compared to the WT mice. These findings illustrate that although EphA4 is upregulated on cortical microglia after TBI, it plays a nonessential role in acute response following TBI.

The Role of Sympathetic Neuronal Pathways in Regulating HSV1 and HSV2 Genital Infection

Authors: G. A. Moore, S. Lee, A. R. N. Abbott, K. L. Johnson, R. Wieske, A. M. Ives, A. S. Bertke

Presenter: Greyson Moore | *Poster and Oral presentation*

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Herpes simplex virus (HSV) is one of the most common STIs and genital HSV lesions have been shown to increase three-fold the risk of acquisition and spread of other STIs such as HIV. This painful, life-long disease is estimated to affect over 85 million people in the US. HSV1 and HSV2 are closely related viruses with HSV1 typically associated with orofacial lesions and HSV2 associated with genital lesions, although these common morphologies are not exclusive of each other. HSV establishes life-long infection by traveling retrograde along neuronal axons after primary infection to establish latency in sensory and autonomic neuronal cell bodies that directly innervate the genitourinary system. The latent virus can then become reactivated by a variety of stimuli, traveling back down the neuronal axons to induce a recurrence of painful lesions. Within the autonomic nervous system, HSV1 shows a preference for the sympathetic pathways whereas HSV2 shows a preference for the parasympathetic pathways suggesting that autonomic pathways may contribute to the difference in recurrence frequencies of HSV1 and HSV2. To determine the contribution of the sympathetic nervous system to acute genital disease and recurrence frequency, guinea pigs were treated with 6-hydroxydopamine (6-OHDA) prior to infection to ablate sympathetic neuronal axons, making them unavailable for infection and the establishment of latency. Chemical ablation of sympathetic axons significantly reduced severity and neurological involvement during acute disease for HSV1, but not HSV2 ($p < 0.05$). Animals treated with 6-OHDA prior to infection also had reduced clinical recurrences by nearly 75% for HSV1 and by 50% for HSV2 ($p \leq 0.001$). Thus, sympathetic pathways play a significant role in acute disease severity and neurological involvement of HSV1, but not HSV2. Additionally, sympathetic pathways are responsible for a significant portion of HSV1 and HSV2 recurrences, with a greater impact on HSV1 than HSV2.

Intestinal Epithelial Cells Are the Root Cause of Colorectal Cancer Following Loss of NIK Protein

Authors: Holly A. Morrison, Audrey Rowe, Kristin Eden, Irving C. Allen

Presenter: Holly Morrison | Oral presentation

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Prolonged inflammation in the gastrointestinal tract that persists for several years culminates in an onslaught of tissue damage and the acquisition of mutations that contribute to cancer development. Inflammatory Bowel Disease patients present with chronic inflammation in the gastrointestinal tract, which makes them three times more susceptible to developing colorectal cancer in their lifetime. This inflammation-induced colorectal cancer is referred to as “Colitis-Associated Colorectal Cancer” (CAC). Here, we are interested in deciphering the root cause of colorectal cancer and the cell-type of origin for tumor development. We hypothesize that the NF-B inducing kinase (NIK) protein is critical for protecting against tumor formation by regulating various cellular signaling mechanisms (i.e. inflammation, cell division, and cell death) and maintaining proper regulation of epithelial cells within the colon. Originally, cancer development is believed to originate from the stem cell compartment, where these naïve proliferating cells become even more hyperproliferative following mutations that contribute to cancerous growths. However, recent work challenges this paradigm including our own research. Our findings using a mouse CAC model for inflammation-induced tumorigenesis reveals that loss of the NIK protein in epithelial cells is the cell-of-origin for tumor formation. This occurs as a resulting imbalance in proliferating stem cells and proper turnover of mature epithelial cells. As a result of this imbalance, epithelial cells compensate for the lack of stem cell activity by avoiding properly scheduled cell death. Therefore, there is a lack of regeneration of new epithelial cells to replace older, damaged ones. These damaged epithelial cells persist in the cell population, acquiring more mutations until they ultimately transform into malignant growths. Our work has clinical relevancy as human CAC patients also have decreased NIK levels. We suggest NIK as a promising biomarker for detecting colorectal cancer in human patients

Practical Application of Machine Learning to Solar Energy

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Presenter: Victor Mukora | Oral presentation

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Forecasting how various weather conditions interrelate to influence solar energy enables enhanced decision making related to the most cost-effective optimizations for photovoltaic cells. Consequently, by testing, creating, and validating an energy prediction model that correlates several environmental predictor variables known to impact solar panels, improvements in solar panel adjustments (like cooling), design, and optimizations can be performed. While research has already been done in this field, our research uniquely offers both prediction and interpretability to better understand the underlying relationships these conditions have on the solar energy yield. In this project, several prediction models including artificial neural networks (ANN), Gradient Boosted Regression Trees (GBRT), multiple linear regression (MLR), Auto Regression (AR), lasso, elastic net, and ridge regression were used for relating environmental variables such as temperature, humidity, or wind chill to the energy production of a home-based solar panel. Multiple functions provided from the model performance package in R verified whether the assumptions for the linear models were met. Using Mean Squared Error (MSE) as the benchmark, cross-validation will be utilized for hyperparameter optimization and hold-out validation for overall predictive model selection. Auto regression performed the best overall and the most dominant conditions were humidity and barometric pressure. This work will help in analyzing ideal locations for solar panel farms and optimizing solar panel design to curb the impact of environmental conditions.

AI Framework for Early Diagnosis of Coronary Artery Disease (CAD)

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Presenter: Elham Nasarian | *Poster presentation*

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The accuracy of coronary artery disease (CAD) diagnosis is dependent on a variety of factors, including demographic, symptom, and medical examination, ECG, and echocardiography data, among others. In this context, artificial intelligence (AI) can help clinicians identify high-risk patients early in the diagnostic process, by synthesizing information from multiple factors. To this aim, Machine Learning algorithms are used to classify patients based on their CAD disease risk. In this study, we contribute to this research filed by developing a methodology for balancing and augmenting data for more accurate prediction when the data is imbalanced and the sample size is small. The methodology can be used in a variety of other situations, particularly when data collection is expensive and the sample size is small.

Neuromelanin Contrasts associated with Attention Deficits Across Lifespan

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Presenter: Joshua Neal | *Poster presentation*

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Attention deficits have been identified through previous research as being related to dysfunctions within the noradrenergic system, including the locus coeruleus (LC). The LC is a nucleus of neurons located within the brainstem associated with the release of norepinephrine, a neurotransmitter associated with broad arousal within the brain and in external components of the nervous system. One method for ascertaining the capacity for proper LC function is through the use of magnetic resonance imaging (MRI). More specifically, a form of structural MRI measure called a neuromelanin contrast ratio can be used to evaluate LC integrity, and has been established in relation to neural performance previously in neurodegenerative models. In the present analysis 120 individuals across the lifespan have been evaluated for attention deficit symptoms equivalent to DSM-IV ADHD classifications, and LC integrity through manual calculation of contrast ratios. The resulting findings support a curvilinear relationship for LC contrast intensity and neural performance across the lifespan, and potentially further a neural model for attention deficits in younger populations.

Developing a Transdisciplinary Approach to Identify Infrastructure Gaps for Lactating People on University Campuses

Authors: Erin Nuckols

Presenter: Erin Nuckols | *Poster presentation*

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College-educated birthers are more likely to initiate infant-feeding from their own milk supply. True numbers are not known, but a conservative estimate of university students (graduate and undergraduate) is that around 30,000 persons are providing human milk to infants while working to achieve their degrees. These numbers are likely to increase given the contemporary reproductive rights issues in the United States. Students and postdocs are still working on their academic progress, while facing the difficult work of balancing their educational goals, their reproductive choice, family-planning, and providing foundational nutrition to their children. It is the responsibility and duty of educational institutions to provide nurturing and supportive physical and social infrastructures for lactating people to meet their basic needs. By law, institutions are required to provide spaces for full-time employees. The literature bears out that the needs of lactating people are not being met in their workplaces and on college campuses. It is an even greater challenge for those who are not protected by law, including students, postdocs, and adjuncts. How can we support these folks when we have yet to fully understand their situation?

Utilizing an innovative mixed-methods approach, this proposed study evaluates the claims made by universities about lactation support and inclusion (proclamations); the creation of space for lactating people to produce milk (action); and the user experiences of lactating spaces (perception). This three-pronged approach allows the work to demonstrate the overall impact of the interrelationships between these proclamations, actions, and perceptions in each case. Methods include institutional ethnography, interviews with facilities personnel, narrative inquiry with lactating people, and environmental assessment of lactation spaces. The goal of this work is to clearly identify the approaches that are being proposed and actions being taken to support underrepresented lactating people as they navigate their personal choices regarding infant feeding.

Exploring the Theory of Racialized Organizations within Black Farmer Organizing for Food Sovereignty

Authors: Nicole I. Nunoo

Presenter: Nicole Nunoo | *Oral presentation*

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Movements for food sovereignty are inarguably socio-political efforts to build collective power and agency within historically marginalized and disempowered communities affected by settler colonialism, white supremacy, and plantation-style agriculture, particularly Black communities in the U.S. South. Subsequently, how Black farmers are doing the work of reclaiming agriculture as a site of freedom and self-determination is integral to the burgeoning food sovereignty discourse. In engaging with Black farmer organizers with similar missions and values, it is vital to note the importance of race in determining access to public and private resources. For instance, how much do group-based or individual-based solidarities and connections between White farmer organizers and Black farmer organizers with similar values shape the access and distribution to resources? This study utilizes Ray's (2019) theory of racialized organizations in exploring the role of Black farmer organizers and their crosssectoral relationships as they re-imagine the food system contemporarily as pathways for liberation, self-determination, and food sovereignty. In this paper, we present preliminary findings from our study conducted through interviews and focus groups with selected Black farmer organizers in Virginia.

Strategic Monitoring of Opportunistic Pathogens in Buildings and Community Drinking Water Distributions Systems

Authors: Tolulope Odimayomi, Amy Pruden, Marc A. Edwards, Charles Edward Via, Jr.

Presenter: Tolulope Odimayomi | *Oral presentation*

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Opportunistic pathogens (OPs) that naturally colonize building plumbing are the leading cause of disease associated with potable water in the United States. Building plumbing provides an ideal environment for the growth of OPs that can cause severe water borne illness in high-risk individuals. Legionella pneumophila bacteria, which causes Legionnaires disease, are especially concerning due to their high mortality rate and the increasing incidence of Legionellosis nationally. Drinking water distribution systems (DWDS) are not typically considered to be a significant source of Legionella, but a new study conducted by the U.S. Department of Veterans Affairs implied that their contribution to Legionella growth may be more important than previously realized. The objectives of this project are to: 1) investigate the potential for DWDS factors to contribute to Legionella growth and 2) identify what sampling procedures and flow rates are most effective at detecting issues. It is hypothesized that low disinfectant residual levels, areas of the distribution system prone to discolored water complaints, high water age, and storage tanks warmed by sunlight will create hot spots for Legionella growth. Sampling at higher flow rates, which can mobilize sediments and biofilms, may be necessary to detect these problems, compared to typical collection of samples at very low flow rates. Sampling data from case studies of the Flint, MI, Quincy, IL, and Trenton, NJ Legionnaires disease outbreaks will be reviewed. Tap water samples from residences and from a pilot scale plumbing rig illustrate the importance of low, moderate, and high flow rates to mobilized microbes and detect problems. Findings from this study will inform protocols and practices for improved monitoring to detect and control OPs.

Historical redlining and current racial disparities in sports and recreational injury hospitalization in the United States

Authors: Tosin Ogunmayowa

Presenter: Tosin Ogunmayowa | *Poster and Oral presentation*

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Approximately 9 million people are injured annually from sports and recreation, more than a third seek treatment in the emergency department, and several thousands are hospitalized for more severe injuries in the U.S. In this study, we examined the association between historical redlining, a government-sanctioned discriminatory practice of the 1930s, and present-day sports and recreational injury (SRI) hospitalization, length of stay, and total hospital charges, and how these relationships differ by race/ethnicity. We obtained 2011 SRI hospitalization data in the U.S. from the National Inpatient Sample (NIS) database, linked it to 1930s Home Owners' Loan Corporation (HOLC) redlining map, and assigned U.S. hospitals to one of three HOLC grades (AB – best/still desirable, C – definitely declining, and D – hazardous). An estimated total of 3,960, 8,570, and 7,176 SRI hospitalizations were recorded nationwide in areas formerly graded AB, C, and D, respectively. Generalized linear mixed models, accounting for sample weight, stratified sampling, and patients clustered within hospitals, were used to examine these relationships. We found no association between HOLC grade and the risk of hospitalization for SRI, even after we stratified the data by race/ethnicity; however, length of stay for Black patients who were hospitalized in areas formerly graded D (redlined) and C was greater than those hospitalized in areas graded AB after adjusting for confounders. We also found that total hospital charges for Hispanic patients who were hospitalized in areas graded C was greater than those hospitalized in areas graded AB. There were no significant associations between HOLC grade and length of stay for White and Hispanic patients, and between HOLC grade and total hospital charges for White and Black patients. This study indicates that redlining, an indicator of structural racism, has a lasting impact on the length of stay and economic burden of SRI among ethnic minorities in the U.S.

Historical redlining and contemporary racial disparities in sports and recreation-related injury hospitalizations in the United States

Authors: Tosin Ogunmayowa

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Approximately 9 million people are injured annually from sports and recreation in the U.S., more than a third seek treatment in the emergency department, and several thousands are hospitalized for more severe injuries. In this study, we examined the association between historical redlining, a government-sanctioned discriminatory policy of the 1930s, and present-day sports and recreational injury (SRI) hospitalization in the U.S. We obtained 2011 SRI hospitalization data in the U.S. from the National Inpatient Sample (NIS) database, linked it to 1930s Home Owners' Loan Corporation (HOLC) redlining maps, and assigned U.S. hospitals to one of three HOLC grades (A+B – best/still desirable, C – definitely declining, and D – hazardous/redlined). Generalized linear mixed models, accounting for sample weight, stratified sampling, and patients clustered within hospitals, were used to examine these relationships. We found no association between HOLC grade and the risk of hospitalization for SRI among all racial/ethnic groups after adjusting for confounders; however, HOLC grade was associated with length of hospital stay (LOS) and total hospital charges per discharge. Black patients who were hospitalized for SRI in historically redlined neighborhoods (grade D) had 38% longer LOS compared to those hospitalized in neighborhoods historically graded as "A+B: best/still desirable". In contrast, White and Hispanic patients who were hospitalized for SRI in historically redlined neighborhoods had 8% and 9% shorter LOS, respectively, compared to those hospitalized in "A+B: best/still desirable" neighborhoods. Total hospital charges per discharge were 29% and 12% lower for Black and Hispanic patients hospitalized in historically redlined neighborhoods compared to those hospitalized in neighborhoods historically graded as "A+B: best/still desirable", but no difference was observed among White patients. This study indicates that redlining, an indicator of structural racism, has a lasting impact on the length of stay and cost of hospitalization for SRI in the U.S.

The Effect of Local Policy Interventions on Subjective well-being(SWB): Evidence from NRTC Program

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Presenter: David Okereke | *Poster presentation*

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The use of tax credit policies for neighborhood revitalization programs as a public policy intervention has become a popular strategy for the federal, state, and local governments seeking to revitalize disadvantaged neighborhoods across the United States. One explanation given by most scholars in the field is the assumption that tax credit incentives result in a trickle-down effect that improves community residents' quality of life experience. Hence, scholars and policymakers have continued to utilize the strategy for neighborhood revitalization initiatives. But these studies have neglected the role of subjective well-being on the program's outcome. That is, to understand whether community residents perceive a relatively positive influence of these programs on their quality-of-life experience. Therefore, despite the robust use of revitalization policies, community residents in neighborhoods with some forms of revitalization programs still experience little or no change in their quality-of-life outlook.

This study examines the relationship between tax credit incentives, neighborhood revitalizations, and community residents' subjective well-being (SWB) in distressed neighborhoods across lowincome communities. The aim is to understand whether community residents perceive a relatively positive influence of these programs on their quality of life experience. In addition, it examines how the perceived satisfaction or happiness from one's interaction with initiatives at the local level can be used as a standard to design and implement public policies tailored to shape people's life experiences.

A model of students' probabilistic reasoning

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Presenter: Modiu Olaguro | Poster and Oral presentation

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The study draws on the notion of students' "lived experiences" to propose a model of probabilistic reasoning. Contrary to what is considered normative probabilistic reasoning (Konold, 1989), I adapted the attributional model of motivation (Weiner, 1994) to make a case for the validity and legitimization of students' informal and subjective reasonings in chance situations, arguing that the existing framework of probabilistic reasoning (Jones et al., 1997) that regard informal or subjective reasoning as a misconception, naïve-thinking, and a deviation from the norm thrives on a deficit perspective that alienates students' lived experiences—as mediated by their culture and beliefs (ethno-mathematics)—from their mathematical realities. Adapting the sensible systems framework (Leatham, 2006), the study hypothesizes students as "sensible beings", ascribing the use of heuristics and other subjectivities (representativeness, luck, God, etc.) as a way of resolving "perturbations" within the probabilistic system relative to logical relationships, clustering, and psychological strength (Green, 1971)—in addition to the classical and frequentist approaches—the hallmark of (formal) school probability. Within this framing, probabilistic reasoning ties to locus (internal/external), stability, and controllability (Weiner, 1994). With evidence from literature (e.g., Savard, 2014), a sequential mixed-methods design (qualitative-quantitative) will be undertaken to explore and test the framework for validity purposes. A major contribution to theory and practice would be the introduction of an alternative framework for classifying, examining, and understanding students' probabilistic reasoning, one that captures and validates the mathematical and probabilistic realities of students both within and outside of the classroom.

Continued Emergence of Lyme Disease in Appalachia

Authors: G. Otieno, K. Kolivras, J. Kim

Presenter: Geoffrey Otieno | *Poster presentation*

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Emerging infectious diseases are on the rise, threatening global human health and healthcare resources. They are infections that have either been present in a population or are newly surfaced in a given population. They are difficult to contain, having a rapid spread, increasing incidence, and increasing geographic ranges. The CDC ranks Lyme disease as the most prevalent vector-borne disease in the United States, with an annual 30,000 reported cases and an estimated 400,000 unreported. The white-footed mouse has been identified to be the most competent reservoir for the Lyme disease bacterium (B. Burgdorferi) in the eastern part of the United States. At the edge of the disease's expanding range, there has been minimal research on the recent spread of Lyme disease in Central and Southern Appalachia. This study seeks to examine the extent of the emergence of Lyme disease in Appalachia between 2000 and 2019 using space-time cluster analysis of the 576,406 cases reported over this period from 423 counties. The findings will help minimize the misdiagnosis of Lyme disease and inform public health action to reduce public vulnerability. Moran's spatial autocorrelation statistic and its visualization via a Moran scatter plot will be used to determine spatial autocorrelation. The Monte Carlo simulations will test the significance of the most likely cluster and derive the p-value by comparing the likelihood test statistic observed to its empirical distribution. Finally, the results will be displayed in choropleth maps to indicate the direction of Lyme disease's continued emergence. The results will be important in understanding the current and future spatial range and impacts of the continued emergence of Lyme disease in Appalachia.

Dramatic changes needed for Americans to meet a healthy and sustainable dietary pattern, according to the Planetary Health Diet Index for the U.S.

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Presenter: Molly Parker | Poster presentation

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Dietary choices are an important avenue for improving the sustainability of the food system. The Planetary Health Diet was proposed by the EAT-Lancet Commission as a reference healthy and sustainable dietary pattern. To assess American adherence to the Planetary Health Diet, a Planetary Health Diet Index for the U.S. (PHDI-US), based on the original PHDI developed for the Brazilian population, was developed and evaluated. Dietary data from 4,738 participants of the National Health and Nutrition Examination Survey (NHANES) 2017-2018 were used to develop and evaluate the validity and reliability the PHDI-US and assess adherence to the Planetary Health Diet. The PHDI-US is made up of sixteen components and scores can range between 0-150. Construct validity was evaluated four ways, including analyzing correlations between PHDI-US scores and energy intake, selected nutrients, and Healthy Eating Index-2015 (HEI-2015) scores. Cronbach's alpha and item correlations were used to evaluate reliability. Differences in scores among sociodemographic groups and Supplemental Nutrition Assistance Program (SNAP) eligibility groups were analyzed through independent t-tests. The results support the validity of the PHDI-US, with the expected low correlations between energy intake and PHDI-US scores, positive correlations with nutrients more prevalent in plant-based foods, and a positive association between the PHDI-US and HEI-2015 scores. Cronbach's alpha was 0.53 and comparable to the value of the original PHDI. The mean PHDI-US score was 39.1 out of 150, indicating that American diets are far from aligning with Planetary Health Diet recommendations. There were significant differences in total PHDI-US scores by gender, smoking status, age, race/ethnicity, poverty income ratio, and SNAP eligibility. Overall, the results support the ability of the PHDI-US to assess adherence to the Planetary Heath Diet among Americans and have identified key areas of focus for improving human and planetary health.

Practical Interventions to Increase the Use of Reusable Bags for Groceries on a Large Scale

Authors: Tyler Parker-Rollins, Rowan Lacey, Evan Alvarez, Lana Nazzal, Karina Daniel, & E. Scott Geller

Presenter: Tyler Parker-Rollins | *Poster presentation*

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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 will be implemented in the Spring of 2023. As data collected in the baseline intervention indicated that young people (under the age of 30) are disproportionately contributing to plastic bag waste), and considering the key theory behind our sign-based approach was to utilize strong ingroup ties associated with the word “Hokies” as an injunctive norm, this upcoming intervention will target members of Greek Organizations at Virginia Tech to promote the use of reusable bags. The intervention will attempt to promote intergroup competition between organizations, thereby promoting the use of reusable bags. The intervention will be alternated at the two grocery stores in a multiple baseline design, in order to show whether this intervention increases the use of reusable bags.

Faucet-mounted point-of-use drinking water treatment as an intervention to reduce exposure to aesthetic and health-based contaminants in rural communities served by private wells

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Presenter: Hannah Patton | *Poster and Oral presentation*

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Drinking water quality and accessibility are common health concerns in rural communities, where social, geographic, and economic challenges can inhibit the provision of reliable municipal water. Households without access to municipal water often rely on private wells, which are solely the responsibility of the homeowner to test, treat, and maintain. These systems often do not employ water treatment and well users therefore can be uniquely susceptible to environmental contaminants. This study aims to reduce previously identified waterborne exposure risks in homes reliant on private wells in southwest Virginia and southern West Virginia through the implementation of faucet-mounted point-of-use (POU) water filters.

Households identified through a Cooperative Extension program as having tap water lead concentrations greater than 5 ppb and/or iron concentrations greater than 300 ppb were recruited and provided a free faucet-mounted water filter (n=20). Participants collected paired samples at filtered and unfiltered taps in their home over a four-week period and completed a survey regarding drinking water perception before and after filter installation. Water samples were analyzed for bacteria and metals concentrations once prior to filter installation and twice post-installation.

Results indicate that most metals of concern were significantly reduced in filtered samples. However, in homes with significant contamination (e.g. iron levels 28x recommended limits), filter reductions were insufficient in meeting recommended guidelines. Although total coliform levels were significantly reduced by filters, bacteria were still present in 45% of filtered samples. While the majority of study participants (72%) used the filter daily, less than half (44%) liked using the filters, with several highlighting issues with low flowrate. Therefore, while faucet mounted POU filters did significantly reduce contaminants of concern, their utility appears limited at present. Further research is necessary to determine exact source water chemistries that are inappropriate for filter use, and to improve filter flowrate to increase user satisfaction.

Communication of uncertainty yin AI regulations

Authors: Aditya Sai Phutane

Presenter: Aditya Sai Phutane | *Oral presentation*

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Scholarship on uncertainty in regulation has focused on theories, strategies, and practices to mitigate uncertainty. However, there is little understanding of how federal agencies communicate scientific uncertainties. This is important for two reasons — One, it highlights what aspects of the issue are quantifiable and how agencies explain uncertainties on the ones that are not. Two, it shows how knowledgeable agencies conceive the audience to be in relation to the issue at hand and what they expect from such communication. By analyzing Artificial Intelligence (AI) regulations across four categories of scientific uncertainties, I find that uncertainty in areas of ownership, safety, and transparency is hard to quantify and hence agencies use personalized examples to explain uncertainties. In addition, they seek public input to gather additional data and bring consensus on issues that have moral implications. These findings are consistent with the literature on tackling uncertainty and regulatory decision-making. They can help advance our understanding of current practices on communicating science effectively during risks and uncertainties.

Connected or Disconnect? Impact of Smartphone Screen Time on Perceived Social Support

Authors: Leila Pruscino, Chris Pereira, Kate McCarthy, Alisha Dow, Joshua Farnsworth, Jack Wardale, & E. Scott Geller

Presenter: Leila Pruscino | *Poster presentation*

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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 Fall of 2022, preliminary data from students in the Center for Applied Behavior Systems was collected and analyzed. The results displayed that individuals with a relatively low screen time reported significantly higher levels of perceived social support from their significant others. In addition, those with higher cell phone screen times scored higher on extraversion, agreeableness, and conscientiousness. The survey is in the process of being launched onto SONA this upcoming Spring to increase the sample size. Furthering data collection could provide a connection between certain personality traits and cell phone usage, and reveal informative correlations between cell phone use and perceived social connectedness.

Using mouse coronavirus to determine the impact of obesity on coronavirus disease severity and identify biomarkers of severe disease outcome.

Authors: Pallavi Rai

Presenter: Pallavi Rai | *Poster presentation*

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The ongoing COVID-19 pandemic continues to be a major threat with new variants constantly emerging. People with COVID-19 exhibit a wide spectrum of clinical symptoms ranging from asymptomatic to death. People with various co-morbidities like diabetes, obesity tend to experience severe, often fatal form of the disease. COVID-19 symptoms are driven by immune-mediated responses of the host to the virus, which is highly dysregulated in people with obesity. In this study, we used a coronavirus that naturally infects mice and found that obese mice had more severe disease than lean mice, suggesting that our model mimics the disease severity observed in people with obesity. We will use this study to identify biomarkers at early time-points of infection. Biomarkers are cell signals that can be used as indicators of normal biological or pathological processes and can be used to predict the outcome of disease in infected patients. We will compare the biomarkers identified from our study with the data available from the blood of COVID19 patients to ensure the reliability of identified biomarkers for predicting the disease outcomes in infected patients.

Institutionalizing a Racialized and Gendered Environmentalism in State Agencies

Authors: Leah Ramnath

Presenter: Leah Ramnath | *Oral presentation*

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The environmental history of the United States is nuanced with lasting ideologies of dispossession, exclusion, and intolerance. Although environmental state agencies have been commissioned to conserve and protect the natural environment, it is enmeshed with this history and formed a particular environmental ideology. As the Environmental Protection Agency (EPA) was established, environmental regulatory agencies (ERAs) were given the responsibility and authority to enforce and implement environmental policies. Considering these aspects of ERAs and the discourses that inform them, it is necessary to investigate how an environmentalism that is both racialized and gendered was constructed. Further, the natural environment became a tool of power and is used as political leverage that functions to perpetuate American ideals soliciting acculturation of U.S. citizens. However, there is some contention as these same agencies have developed towards maintaining a diverse employee population within ERAs itself. This leads to question how a racialized and gendered environmentalism in ERAs have been institutionalized and navigated while simultaneously creating goals to recruit diverse employees amid conflicting ideologies. In this work, I use a feminist political ecology framework to interpret how women of color employees at a particular ERA understand their experiences as environmental enforcers and regulators.

Developing Focused Ultrasound Histotripsy for the Non-invasive Ablation of Tumors in Companion Animals

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OBJECTIVES Spontaneously-occurring tumors in companion animals represent a unique comparative oncology model for human cancers. Histotripsy is a non-thermal, non-invasive focused ultrasound therapy using controlled acoustic cavitation to mechanically disintegrate tissue. The objective of this study was to investigate the feasibility of targeting and ablating sarcoma and brain tumors with ultrasound-guided histotripsy in pet dogs and cats with spontaneous tumors.

METHODS Studies in collaboration with the Virginia-Maryland College of Veterinary Medicine investigated histotripsy ablation of tumors in client-owned dogs and cats. Patient-specific treatment plans were developed for histotripsy experiments using pre-treatment CT, MR, and/or ultrasound imaging. A 500 kHz or 1 MHz histotripsy system was used to target tumors non-invasively and guided by real-time ultrasound imaging. Planned spherical ablation volumes were applied to a portion of patient tumors before surgical resection. After treatment, the ablation volume was assessed on post-treatment CT or MRI, and the ability to generate effective ablation of the targeted tumor regions was evaluated grossly and histologically.

RESULTS Fifty tumors were treated – 47 canine tumors (30 osteosarcoma, 3 chondrosarcoma, 1 osteoma, 10 soft tissue sarcoma, 2 meningioma, 1 hemangiosarcoma) and 3 feline tumors (all soft tissue sarcoma). Generation of histotripsy bubble clouds was confirmed using ultrasound imaging and/or passive cavitation detection for all tumors. Post-treatment images showed clearly defined ablation zones with no off-target injury, and all animals recovered well after treatment. Gross areas of tissue damage were visible in targeted regions following histotripsy, and histology of treated tissues revealed effective ablation marked by hemorrhage, necrosis, acellular debris, and distinct boundaries between treated and untreated regions of the tissue.

CONCLUSIONS Results demonstrate histotripsy's ability to precisely target and ablate veterinary sarcoma and brain tumors. Future studies are warranted to explore the role of histotripsy as a front-line therapy for these and other tumors in animals and humans.

With Hope: Rhetorical Pronoia, Multidisciplinary Research, and Empathetic Teaching in the First Year Writing Classroom

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In 1984, scholar Fred H. Goldner defined pronoia as "...the positive counterpart of paranoia. It is the illusion that others think well of one" (82). But beyond the theorization of condition, the Greek word pronoia more broadly encompasses " 'care', 'solicitude' and in its sublime (theological sense) the 'divine care' or 'providence'" (Kazhdan 133). In this context, rhetorical pronoia is theorized to represent "tactical foresight" (Muellер, 2016) or, quite simply, thinking to the future with hope. Whether a condition or heuristic, a method or a framework, rhetorical pronoia remains a concept ripe in possibility, an all-encompassing, changeable locus of potential to allow students to define their future narratives, both in research and beyond. This presentation will explore the role of rhetorical pronoia and multidisciplinary research in the composition classroom, including potential curricular framings, empathetic teaching techniques, and course design methods to encourage students to model care in their writing and imagine speculative futures – visualizing what is possible in a world that sometimes feels impossible.

Incorporating Virtual Reality into Architectural Design Concepts

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Incorporating virtual reality (VR) into the early stages of the architectural design process, specifically during the massing stage, has the potential to revolutionize the way architects approach design problemsolving. The traditional design process, consisting of ideation, representation, and iteration, relies on sketches, drawings, and prototypes to translate abstract ideas into tangible forms. However, these methods do not allow architects to fully contextualize their designs within the project site in the early stages of the process. This limits the exploration of alternative design solutions and can result in missed opportunities for innovation. This research aims to explore the potential for VR to bridge the gap between abstract thought and contextualized design. Architecture is a unique form of spatial storytelling, connecting the past, present, and future and engaging all the senses of human perception. As such, the site of a project is a crucial factor in the design process, impacting the final design's directionality, orientation, light, view, and other features. By incorporating VR into the massing stage of design, architects can better envision their design ideas within the project site and make more informed decisions. The findings of this research can have significant implications for the next generation of architects, offering them a new framework for exploring design alternatives and contextualizing their ideas within the project site.

A novel combination of Amphotericin B and Lansoprazole to combat the fungal superbug Candida auris, targeting the mitochondrial cytochrome bc1 complex

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Candida auris has emerged as a problematic fungal pathogen associated with high morbidities and mortalities. Amphotericin B is the most effective and broad-spectrum antifungal agent used for treatment of invasive fungal candidiasis with extremely rare resistance among clinical isolates. However, the clinical efficacy of this drug has been impacted recently with the emergence of C. auris which possessed extraordinary resistant profile against all available antifungal drugs, including amphotericin B. There is an urgent need for novel antifungal agents or co-drugs capable of restoring/enhancing the antifungal activity of amphotericin B and reducing its toxicity. In this study, by screening a panel of ~3,400 FDA-approved drugs we identified the proton pump inhibitor, lansoprazole, as a potent enhancer for the activity of amphotericin B against C. auris. Lansoprazole exhibited potent synergistic interactions with amphotericin B against 18/20 (90%) C. auris isolates with ΣFICI ranged from 0.25 to 0.5. Proteome Integral Solubility Alteration (PISA) assay revealed that lansoprazole inhibits an essential target in the yeast cytochrome system (Rieske protein of the mitochondrial cytochrome bc1 complex) leading to increase in the oxidative stress in the fungal cells which consequently augment the oxidative damaging effect of amphotericin B on C. auris cells. The target was confirmed with the rotenone rescue assay and transcriptome sequencing (RNA-Seq) analysis. Most importantly, lansoprazole restored the in vivo efficacy of amphotericin B in an immunocompromised mouse model, resulting in a 1.7-log (~98%) CFU reduction in the kidney burden of C. auris. In conclusion, our results identified lansoprazole as a potent enhancer to the antifungal activity of amphotericin B in addition to identification of mitochondrial cytochrome bc1 as a novel drug target to overcome the antifungal resistance in C. auris.

Development of a Medical Device to Treat Tumor Acidosis Using DC pulses

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Tumor acidosis is a hallmark of cancer and a driver of immune suppression. Extracellular pH in solid tumors such as malignant melanomas, brain tumors, sarcomas, breast cancer, squamous cell carcinomas, and adenocarcinomas can range 1-2 units lower compared to non-neoplastic tissue. Minimal therapeutics target tumor acidosis, with the most common route being an oral diet of sodium bicarbonate (commercial name TUMS). Bicarbonate is an effective method of increasing the pH of tissue, but clinical studies prove ineffective due to poor patient compliance and gastrointestinal issues. In this study, we look to develop a localized treatment of pH dysregulation using the cathodic reactions of pulsed electric fields. Uniformly, when an electric field is applied across tissue, there results a pH imbalance at the electrode-tissue interface. Through in vitro and ex vivo methods, we demonstrate that with proper pulse parameter selection, a regulated increase in pH can be generated to mitigate the immunosuppression of the tumor microenvironment. Our results from agarose tissue phantoms demonstrate a significant relationship between the applied current and the resulting pH change. Additionally, we show the cathodic, or alkaline, reactions can overwhelm the anodic, or acidic, reactions by manipulating the relative surface areas of the electrodes. Furthermore, we culture macrophages, a common immune cell, in a monolayer to develop target pH thresholds for viability and activation. Finally, we deliver these pH changes to an ex vivo porcine liver to demonstrate proof of concept. The wellestablished technology of electroporation supports clinical relevance within oncology. Irreversible electroporation (IRE), a focal ablation modality, creates a cascade of immune response due to its primarily non-thermal cell death mechanisms. Conveniently, clinicians could use the technology described in this study in conjunction with IRE, possibly supporting the pro-inflammatory immune response of IRE.

Being disconnected feels bad, even when interacting with computer players

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To better understand human interaction with the environment, this study explored how changes in the environment might affect emotional reactions. In this study, subjects experienced a loss of connection with computer generated virtual players while playing Cyberball, an online ball-throwing game. A manipulation was made in the number of balls thrown to the subjects, with the control and experimental groups receiving 20% and 4%, respectively, of the total balls thrown. The experimental group was predicted to experience more negative feelings and show greater change in bodily signals (e.g., decreased heart rate) than the control group. Physiological data (Figure 1), including electrocardiograph, impedance cardiograph, electrodermal activity, facial electromyograph and respiration were acquired from 48 subjects (25 male; mean age 20.9 yrs.) who played the Cyberball game and watched two film clips for 10 minutes (Figure 2). After that, subjects reported on their main emotions and how intensity of feelings changed over time. Self-report data are reported here. These data show that 91% of subjects in the experimental group reported feeling anger, contempt, disappointment, or surprised, whereas 88% of control subjects reported feeling neutral or happy. Change in the intensity of feelings during Cyberball game divided by change during the sad film was calculated and compared across the two groups. This relative proportion indicates the effect of the manipulation on the subjects' affective experience. The Q-Q plots (Figures 3a and 3b) show that this proportion is close to normally distributed, save for a few outliers. A two-sample t-test with unequal variances (Figure 4) reveals statistical significance (t=2.49, p=0.01). These findings suggest that even when the players are not real, seeing a loss of connection automatically triggers a negative response. Such evidence supports the notion that self and the environment are inseparably coupled.

Figure 1: Physiological Response and Subjective Experience

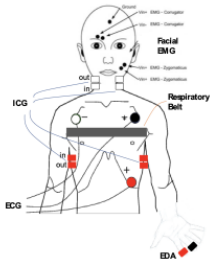
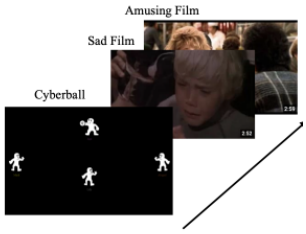
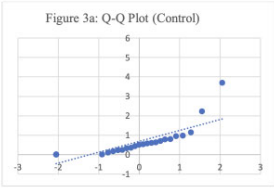


Figure 2: Effect of Loss of Connections





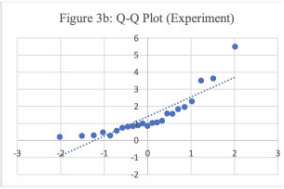


Figure 4: Two-sample t-test (unequal variances)

	Control	Experiment
Mean	0.64	1.41
Variance	0.65	1.62
Observations	25.00	23.00
df	37.00	
t Stat	2.49	
P(T<=t) one-tail	0.01	
t Critical one-tail	1.69	

Of Race and Caste: Discrimination Across Cultures in Shakespeare's Othello and Bhardwaj's Omkara

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Presenter: Zainab Shamim | Oral presentation

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Shakespeare's Othello has long been the center of academic attention due to its characterization of Othello as a Moor. Racism against Othello drives much of the play's action, leading to Othello's own internalization of anti-Black sentiments Furthermore, given the popularity of Shakespeare's works, adaptations of the Bard's plays continue to grow in relevancy. These adaptations allow for Shakespeare's classic stories to be retold, entertaining old and new fans alike.This paper examines Vishal Bhardwaj's Bollywood adaptation of Othello, Omkara. In the film, Bhardwaj transports Othello into contemporary Indian society. In particular, I argue that Bhardwaj uses the film to explore issues of casteism and colorism within modern Desi culture, mirroring the prejudice that Othello faces in Shakespeare's play. To make this argument, the paper explores how Othello depicts racial outsiders in sixteenth-century Europe before turning to an examination of how Omkara depicts the caste system in contemporary Uttar Pradesh, India. Comparing the adaptation to the original play helps us better understand how Othello and Omkara are characterized as members of discriminated groups within their respective communities.

Multishot Adversarial Network Coding

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Transmissions of data over networks affected by external noise have been the subject of intensive research. These network communications rely on organizing the messages sent into small packages that will be delivered to terminals through a distribution system. In 2018, Ravagnani and Kschischang initiated the study of communication networks subject to an adversary that can corrupt a subset of the network edges. The adversary can change the symbols associated with these edges, but cannot erase them. This study was further by Beemer, Kilic and Ravagnani with particular focus on the one-shot capacity of the network, which provides information on the maximum number of symbols that can be sent/decoded in a single use of the network. Inspired by this work, we studied the scenario where a network can be used multiple times under different assumptions on the adversarial model. We derive bounds on the number of symbols transmissible with the presence of a restricted adversary and we develop communication strategies for particular families of networks including networks with the Diamond Network and the Mirrored Diamond Network as a subgraph.

Examination of Emotion Socialization During Early Childhood Among Parents From Eastern Cultures

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Theory and research have shown that parent emotion socialization (ES) practices are strongly associated with and predictive of children's social-emotional outcomes (e.g., emotion regulation). There is growing recognition that ES needs to be interpreted within a socio-cultural context.

Given that current ES research has primarily been conducted with families from Western cultures, it is critical to examine parent ES practices in Eastern cultures. Further, the existing research within Eastern cultures has generally focused on families from one or two countries. As such, the current project aims to acquire empirical knowledge on ES practices during early childhood among parents from a range of Eastern cultures. It was hypothesized that the factor structure of parent ES practices and associations with child social-emotional outcomes for Eastern cultures will be different than the ES framework developed with White populations. Participants included 159 caregivers (70% female) of toddlers and preschoolers born in East Asia, South Asia, or the Middle East (47% currently living in the United States). Exploratory Factor Analysis indicated that a three-factor model was the best fit for our data. Parent distress reactions and expressive encouragement loaded onto Factor 1, punitive and minimizing reactions loaded onto Factor2, and emotion-focused reactions, problem-focused reactions, and expressive encouragement loaded onto Factor 3.

Consistent with research conducted with Western populations, maladaptive parenting practices of punitive and minimizing responses are strongly associated with higher levels of child internalizing and externalizing problems. However, different from the ES framework based on Western populations, expressive encouragement loaded on to both adaptive and maladaptive responses for parents from Eastern backgrounds. These findings enable a better understanding of which practices are adaptive versus maladaptive for Eastern children during early childhood, which in the long-term, will support the development of culturally relevant interventions to facilitate early social-emotional development for Eastern populations.

Benthic and emergent macroinvertebrate community responses to hydrological variation across geographically isolated wetlands

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Presenter: Elizabeth Sicking | Poster presentation

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Geographically isolated wetlands support high invertebrate diversity and secondary production that provides an energetic connection between aquatic and terrestrial landscapes. Annual and seasonal changes in precipitation and temperature are impacting hydrologic regimes and, in turn, the abundance, composition, and emergence timing of macroinvertebrates in isolated permanent and temporary wetlands. However, the impacts of changing hydroperiods on emergence timing and subsequent energy exchange between terrestrial and aquatic ecosystems are understudied. Temporary wetlands are particularly vulnerable to reduced periods of inundation that could eliminate insects that lack adaptations for drying. This study aims to understand how different hydroperiods impact benthic and emergent insect and non-insect macroinvertebrate communities in geographically isolated wetlands on the Gulf Coastal Plain in SE USA. We predict that: 1) the abundance and biomass of emerging insects will increase with hydroperiod length due to greater habitat availability and stability, 2) increased hydroperiod variability will decrease the abundance and biomass of the emergent population because of abbreviated time for growth, and 3) emergence timing will differ depending on hydroperiod length. Benthic and emergence samples will be collected from two types of isolated wetlands (sedge-marsh and cypress-swamp) across the hydroperiod. We will assess richness (S), abundance (N), and biomass (B) within individual wetlands, between wetland types, and between benthic and emergent samples. Hydrological and thermal patterns that influence the composition and life cycle of insects are increasingly changing in isolated wetlands that continue to lack the protective environmental policies afforded to other freshwater habitats. Because of this, it is vital to further investigate the relationship between emerging insects and their surrounding terrestrial habitats, and continue to expand our knowledge of how emergence timing and both insect and non-insect macroinvertebrate communities respond in the face of hydrological variation.

OPTIMIZING DIALYZER DESIGN: A REGIONAL COMMUNAL NEED

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According to the CDC, more than 1 in 7 US adults are estimated to have chronic kidney disease. Patients in the later stage of this disease are prescribed hemodialysis, after which the median life expectancy is only 5 years. Unfortunately, the southeast continental US, including Appalachia, suffers the highest death rate from this disease. Remarkably, the basic design of hemodialyzers, or artificial kidneys, hasn't changed significantly since the hollow fiber dialyzer was introduced in the 1960s. Hemodialyzers contain tens of thousands of parallel hollow fibers with semi-permeable membranes. Blood flows through the fibers and the dialyzer fluid (dialysate) flows around them in the opposite direction. Toxins are cleared from the blood to the dialysate by virtue of differences of concentration (diffusion) and pressure (convection), across the fiber membranes. A growing body of evidence reveals that current dialyzer designs and operating regimes aren't optimized. Efforts to improve the performance of hemodialyzer are hindered by the complex geometry of the dialyzer. Hence, current studies just consider results from a single fiber, or the entire dialyzer is modeled as one porous medium. Both approaches neglect the critical inter-fiber interactions and physics. For the first time, we developed a multifiber model that can capture this interfiber interaction and tested it on geometric parameters taken from six different commercially available dialyzers. The model was able to generate turbulence effects that have been observed in some hemodialyzers that are not captured by other models. We found that the number of fibers needed to accurately predict the performance of the dialyzer depends on the fiber packing density. The higher the fiber packing, the higher the deviation from the single fiber result. Due to all these capabilities, the model could be used to improve the designs of hemodialyzers, ultimately impacting millions of patients worldwide.

Development of subtype-specific layers in ventral regions of mouse visual thalamus

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Intoduction/Background: Axons of retinal ganglion cells (RGCs) convey visual information from the outside world to numerous brain regions and organize that information at several levels, including the cells of neurons in visual thalamus. The two major divisions of visual thalamus are the dorsal lateral geniculate nucleus, which is important for classic image-forming vision, and the ventral lateral geniculate nucleus (vLGN), which is associated with non-image-forming vision. Due to the paucity of studies into its structure and function, the role of vLGN in the visual system remains unknown. Grossly, vLGN is divided into an external vLGN (vLGNe) that receives direct input from the eyes and an internal vLGN (vLGNi) that does not. We previously found that vLGNe consists of distinct subtypes of inhibitory (GABAergic) cells distributed into at least four adjacent layers.

Objectives: To elucidate the developmental timeline for the formation and maintenance of inhibitory cells in mouse vLGNe.

Materials & Methods: Three C57BL/6J (control) mice were used for each experiment. Mutant mice included three replicates each of Fgf15 −/− and Math5 −/− mice. Experiments were performed using a combination of immunohistochemistry, intraocular injections of fluorescently-conjugated cholera toxin subunit B, and in situ hybridization.

Results: We observed that mutant mice without retinal inputs have vLGNe laminar distribution of inhibitory cells at birth, suggesting that they do not depend on retinal axons for their formation. However, after the first week of postnatal development, these mutants exhibit a dramatic disruption in organization of inhibitory neurons and the separation of vLGNe and vLGNi.

Conclusions: Our results show that the subtype-specific distribution of inhibitory cells in vLGNe are determined during embryonic development. While their formation does not depend on retinal inputs, retinal signals are critical for the maintenance of this layered organization.

An examination of the influence of sociodemographics on private water quality and consumption in Southwestern Virginia

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Although water produced by community water sources is subject to monitoring and reporting requirements by the EPA, the quality of water sourced from private systems such cisterns, springs, and wells, is solely the responsibility of the individual homeowner. Past research indicates that homeowner awareness and available resources may limit their ability to responsibly manage their systems. This study aimed to identify potential connections between sociodemographics and drinking water quality and use among residents reliant on private water supplies in six southwestern Virginia counties (Montgomery, Giles, Craig, Franklin, Pittsylvania, and Roanoke). Samples were collected through partnership with an ongoing Cooperative Extension program that provides low-cost water quality testing and education. Over 43% of the 665 participating households had never tested their water before, though EPA and the Department of Health recommend annual testing. Nearly half (48%) of submitted samples exceeded at least one EPA Maximum Contaminant Level (most common exceedance = coliform). Preliminary results suggest that both water management and water quality differ across self-reported household income categories (52k, 53-97k, >98k). For example, while 10% of samples submitted by homes in the highest income category contained > 5 ppb lead, more than 38% of samples in the lowest income category contained >5 ppb. Higher income homes were more likely to employ treatment post extraction such as water softeners, reverse osmosis, and iron removal. Water quality likely impacts consumption: while only 3.3% of upper income households do not drink their water, over 16% of the lower income households do not drink their water. These results were not unexpected given previous reports of trends in municipal water quality but do represent a first examination of these trends amongst private systems in Virginia.

A Trp with Brucella abortus

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As one of the primary building blocks in biology, amino acids can quickly become a key asset for bacteria to infect a host. The bacterial pathogen Brucella abortus is able to synthesize tryptophan (Trp), but it is very energetically demanding to produce. In order to be efficient, Trp biosynthesis is repressed by a variety of methods when environmental Trp levels are above a certain threshold. In these conditions, transcriptional attenuation of trpE leads to a smaller RNA product (rnTrpL) that then represses other genes involved with Trp biosynthesis. In the closely-related bacterium Sinorhizobium meliloti, rnTrpL also regulates genes unrelated to Trp biosynthesis, including those involved with quorum sensing and drug resistance. It is unknown what regulatory targets rnTrpL has in B. abortus, and few phenotypes have been observed when trpL is deleted. Despite a lack of virulence defects in both macrophage and mouse models of infection, a growth defect in the trpL mutant was observed when grown in a defined medium with very low Trp concentrations. Although this is counterintuitive to the proposed model, current work is focused on ensuring the trpL mutation did not affect trpE expression and defining the TrpL regulon via RNA sequencing

Neuronal RNA-Protein interactions in Hippocampal Dendrites

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Neurons are the longest cells in our body with highly elaborate and asymmetric morphologies. This morphological complexity requires tight regulation of where and when proteins are made since proteins are the key operators of diverse cellular functions. Research has shown that neurons transport mRNAs to distant neuronal branches, also known as dendrites, to synthesize proteins locally to maintain their structure and functionality. One such function is to form the specialized sites of contact between neurons called synapses. When we create memories or learn new tasks, certain synapses are selectively modified and strengthened. Quick and efficient protein synthesis ,using local mRNAs as a template, is required to stabilize these modified synapses. Trafficking of mRNAs made in the cell bodies to distant sites for local protein supply is coordinated by RNA-binding proteins (RBPs). Fragile X messenger ribonucleoprotein (FMRP) is an ubiquitous RBP that can bind to and regulate the transport and local translation of ~4% of RNAs in the brain. Genetic loss of FMRP causes Fragile X syndrome (FXS), the most prevalent familial form of learning disability and autism. Genetic studies have identified RNA targets that bind to FMRP. However, these studies are insufficient to answer how a single protein can interact with and regulate so many RNAs with diverse functions while also contributing to local translation and learning. Technical challenges in imaging more than two molecules at once has also limited the ability to study FMRP-RNA interaction within cells. To address this gap in knowledge, we are visualizing dozens of FMRP-RNA interactions within hippocampal dendrites at baseline and after learning-induced neuronal activity. Increased understanding about the molecular mechanisms of FMRP mediated RNA regulation at neuronal synapses will advance our knowledge of FMRP biology and better equip us to explore how their alterations lead to learning impairments in FXS patients.

The Impact of High School Region Socioeconomic Status on Introductory Computer Science Course Performance

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Presenter: Jennifer Alexandra Thompson | Oral presentation

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Post-secondary introductory programming courses (also known as CS1) has been shown to be an exceptionally challenging topic for novices to grasp. Research in computing education has been steered towards understanding early indicators of student performance, in order to understand what factors lead students to succeed in CS1. A major finding of these research efforts has been that high school courses and prior programming experience are important indicators in predicting success in CS1. However, the socioeconomic status surrounding the student has not been well explored as an indicator of CS1 performance. Specifically, a student's high school socioeconomic status has not been well investigated as a source of educational success in post-secondary computing. In this research, we propose a method that examines a student's high school region socioeconomic status and determines whether there is a correlation to CS1 passing rates. Ideally, we would have liked to investigate the socioeconomic status and quality of the high school itself, but this information is not standardized and publicly available. Instead, we investigate variously sized regions surrounding the high school, to understand the socioeconomic status of the region the high school is in. We utilize multiple socioeconomic indices that examine three differently sized regions around a student's high school. After proposing a method to examine if there are any correlations between these measures surrounding a student's attended high school and the student's performance in CS1, we perform a case study using seven years of CS1 student records from our institution. In our initial findings, we see that students from more advantaged high school regions tend to pass CS1 more frequently. Since our findings indicate that high school region socioeconomic status may be a factor in a student's performance, we argue that that this factor should be considered when studying student performance.

The Impact of Stroke on Somatosensation

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INTRODUCTION: Clinical assessments indicate that upwards of 6 million individuals with stroke have somatosensory deficits. Up until now, research has only focused on how the Central Nervous System (CNS) impacts somatosensation, and it remains unknown if changes at the Peripheral Nervous System (PNS) could elicit these deficits. In this work, my aim is to provide preliminary insights into how the PNS can impact somatosensation.

METHODS: A peripheral nerve conduction assessment was conducted at the median, radial, and ulnar nerves in both arms of three participants with stroke and six similarly-aged controls. For each nerve, a stimulator electrode was placed at a fixed distance proximal to a surface electromyography (sEMG) sensor. An electrical stimulus was applied to the nerve and the sensory nerve responses, specifically amplitude and latency, were obtained.

RESULTS: No significant differences in latency were found between the arms of the participants with stroke and controls for the median ($p=0.1568$), radial ($p=0.5606$), and ulnar ($p=0.9878$) nerves. No significant differences in amplitude were found between the arms of the participants with stroke and controls for the median ($p=0.2303$), radial ($p=0.9320$), and ulnar ($p=0.9279$) nerves. CONCLUSION: This research provides preliminary data for future work in which I will address how sensory nerve signal transmission corresponds to somatosensory perception post stroke. The implications of this study include how clinicians assess and provide rehabilitative care for sensorimotor deficits in patients with stroke.

Proliferation, Plasticity, and Migration: Exploring the synergistic relationship between eosinophils and TH2 cells in development of HES-like syndrome

Authors: Brie Trusiano, I.C. Allen

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Eosinophils are white blood cells with pink staining granules that cooperate with T helper 2 (TH2) cells to combat parasitic pathogens. However, disruption of eosinophil proliferation, activation, and migration can lead to increased numbers of eosinophils that can damage tissues and organs. Hypereosinophilic Syndrome (HES) is a disease with an unknown underlying cause that affects humans and veterinary patients. Previous mouse studies have demonstrated involvement of the noncanonical NF-κB signaling pathway, a cellular pathway that is regulated by NF-κB inducing kinase (NIK) in development of HES-like syndrome. Specifically, deletion of NIK in these mice (NIK-/- mice) polarizes T cells into the TH2 subtype, which subsequently increases the number of circulating and tissue eosinophils. However, the intricacies of eosinophil development, education, and migratory capacity has not been assessed during development of HES-like syndrome in the Nik-/- mouse model. Here we show that loss of NIK potentially enhances eosinophilic migration to eotaxin (CCL11) and affects eosinophil proliferation, retenention, and development in the bone marrow and spleen. Taken together, these results highlight a synergistic relationship with TH2 cells and their respective signaling molecules during development of HES-like syndrome in Nik-/- mice. Overall, these findings warrant further study to better characterize the relationship described above to better understand development of HES and HES-like diseases. Furthermore, these results may also suggest a role for NIK and the noncanonical NF-κB signaling pathway when attempting to better characterize, diagnose, and treat blood disorders such as eosinophilic leukemias or paraneoplastic eosinophilia associated with T cell lymphoma.

Activation of cell apoptosis pathway as potential antiviral against neurovirulent viruses

Authors: Morgen VanderGiessen, Victoria Callahan, Brian Carey, Kylene Kehn-Hall

Presenter: Morgen VanderGiessen | *Poster presentation*

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Equine Encephalitis viruses are a group of mosquito transmitted viruses which can cause severe illness in humans and are classified as a high-risk pathogen due to their ability to be easily aerosolized for use as biological weapon. These viruses cause mild flu-like illness which progresses to neurological disease including behavioral problems, seizures, and neurodegeneration in up to 14% of human cases and >90% of equine cases. There are currently no publicly available vaccines or antivirals to treat equine encephalitis viruses including eastern equine encephalitis virus which can cause 50-75% mortality in humans. Therefore, it is of urgent public health risk that we investigate the viral pathways which lead to viral replication and develop novel antivirals to target these viruses before an outbreak induces long-term neurological consequences. These viruses utilize a structural feature, named the capsid protein, to protects viral genomic material, promote pathogen invasion, and inhibit host genomic replication. Its multifaceted role in promoting viral replicating and inhibiting host defenses makes it a promising antiviral target. Interestingly, the capsid protein of some other encephalitic viruses has been demonstrated to modulate the activity of cell apoptosis (programmed cell death) to promote viral development and enhance viral replication. Here we investigated the activity of p53/HDM2 apoptosis pathway following infection with Venezuelan equine encephalitis virus and tested the antiviral activity of apoptosis targeting drugs. Ultimately, this study highlights the potential for HDM2 inhibition and p53 activation as a potential broad-spectrum antiviral against encephalitic viruses.

Modeling Influence of Turgor Pressure on Cellular Adhesion

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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 mechanical properties of the cell, including the membrane elasticity and the turgor pressure. Turgor pressure is the pressure difference inside a fluid filled cell compared to the fluid surrounding the cell. Experimental characterization has revealed the importance of cell mechanics governing the adhesion process. However the role of turgor pressure, cell stiffness, work of adhesion, and external forces on the cell attachment process remains unclear. To address this gap, we developed a theoretical model to capture the adhesion of a spherical pressurized elastic membrane. The governing equations are derived by minimizing the total potential energy of the system. We find that as the turgor pressure increases, the area of the cell in contact with the surface decreases. For weak adhesion, we recovered the power law scaling between contact size and work of adhesion. We examined the effect of external forces on the adhered cell to capture the force separation response and estimate the detachment. 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.

Metal 3D Printing: Strategic Design of Parts for Increased Density and Strength in Binder Jetting

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Additive manufacturing, or more commonly known as 3D printing, is perhaps most recognizable in the form of colorful plastic parts with quality at that of the hobbyist level. However, much of the general population is unaware of other types of additive manufacturing processes that are capable of printing production level metal parts. In particular, binder jetting is a type of additive manufacturing process where metal parts are formed by selectively printing liquid binder onto a bed of metal powder to bond the loose powder into the desired part shape. Immediately following printing, the part shape is weakly held together entirely by the strength of the liquid binder, and the parts are very fragile. These parts must be carefully transferred into a high temperature furnace to allow metal particles to bond and form a strong part. Despite the advantages offered by the process, binder jetting is rarely used in industry for metal manufacturing because final parts often have high porosity and thus low density. Therefore, research on improving density in binder jet parts is critical for advancing the field. In this work, it is observed that the liquid binder used in binder jetting plays conflicting roles: binder is necessary to form strong enough parts for handling pre-sintering but binder also causes porosity and low density in parts post-sintering. Thus to balance the contradictory needs between providing simultaneous sufficient pre-sinter and post-sinter part density and strength, a lattice infill design strategy is explored. Experimental results of printed 316L stainless steel demonstrate that octet lattice infilled parts are capable of simultaneous high pre-sintered part strength while also providing an increase in sintered part relative density over full-saturation parts.

NLRX1 Modulation of Sars-CoV-2 Immune Response

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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-κB pathway, which regulates cytokines such as IL-6 and TNF-α. 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.

Digital Twins for Management of Socio-technical Systems – Current Trends, Limitations, and Opportunities

Authors: Md Doulotuzzaman Xames, Taylan G. Topcu

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This paper outlines the limitations and opportunities of the Digital Twin (DT) technology for management of socio-technical systems (STS) that rely on a collaboration of teams of humans & technology, such as healthcare systems. DTs received an increased scholarly attention over the past decade, and the recent advances in the fields of artificial intelligence, machine learning, and internet of things have only accelerated their practical adoption. The literature suggests that DTs are being predominantly developed for, and implemented in, well-controlled engineered application areas, such as manufacturing, mechanical, aerospace, and energy systems. DT applications in STS, despite their relevance and tremendous potential, have been rather nascent. In this paper, we focus on DT research in healthcare systems, as a representative of STS, to discuss current research trends, characterize some key limitations, and outline research trajectories for leveraging DT technology for effective management of STS. We find that vast majority of DT studies in STS focus on a specific facet of the broader system, such as an engineered product or a process, and do not aim to capture the interdependencies between social and technical spheres in a holistic manner. Although challenging, this is a critical research gap that needs to be addressed for STS given that their performance, and similarly failures, often originate from these socio- technical interdependencies. We contend that DT technology can be leveraged to model human-in-the-loop system as a socio-technical whole, enabling data-driven equitable management by taking interests of all associated stakeholders into account, including providers, managers, and the public.

On the Sein of Zen: The Retrospection of Nothingness in the Architectural Impulse of Frank Lloyd Wright

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Historically, it has been an esoteric quest to define the being of form and space in architecture. While Platonic metaphysics tends to "substantialize being and dichotomize the real," it does not earn its credit amid the divorce between form and space in the modern context. Unlike in a Gothic cathedral, modern space is no longer the remnant of its structural form given that modern men are born with more spatial requirements of heterogeneity than limited forms. Caught in the debate between form-makers and space-makers around the 1920s, Frank Lloyd Wright (1867-1959), the celebrated modern pioneer, offered to resolve this puzzle by turning to the teaching of Zen, videlicet, the nothingness as the being of architecture. "It was the Buddha," wrote Wright, "who noticed that the spoon may lie in the soup for a thousand years and never know the flavor of the soup," albeit his ideas have never drawn enough attention. Theory as such was never news for a rank of his contemporary philosophers, like Nishida Kitaro (1870-1945) and Martin Heidegger (1889-1976). Kitaro, in his 1928 essay The Intelligible World, openly claimed that nothingness, though unintelligible, serves as the basis of our intelligible world; while Heidegger, when investigating this issue in his approach to Zen, was fascinated by this "nothingness" but disturbed by the deficiency of language in uttering its deed. He tried putting it Sein (being) though it never satisfied him. Hereto comprehend the unity of being and nonbeing in the nothingness of Zen, this research will, by revisiting some of Wright's designs like Taliesin and Fallingwater, aim at an inquiry of three fundamental questions in architecture: How to form the formless? Should it be a space in a non-place or a non-space in a place? Is space intelligible?