35TH GSA RESEARCH SYMPOSIUM

27 MAR 2019 | 9 AM to 7 PM | Graduate Life Center

GRADUATE STUDENT ASSEMBLY
GSA

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The co-chairs also wish to extend their sincere thanks, admiration, and respect to all of our volunteer judges, to the volunteers who made this day possible, and to Chelsea Corkins, GSA Program Chair, for her energy, support, and incredible leadership.

KEYNOTE SPEAKER

JOE HANSON, Ph.D.

Joe Hanson

Science Writer, Biologist, Video Producer & Educator

Joe Hanson, Ph.D., is a science writer, biologist, video producer, and educator. His quest is to explore ways that digital storytelling can help people think more deeply about the universe they live in.

He's the creator and host of It's Okay To Be Smart, an award-winning science education show from PBS Digital Studios that celebrates curiosity and the pleasure of finding things out. It's Okay To Be Smart has amassed 2.6 million subscribers and earned more than 200 million views on YouTube. In 2017, Joe won the Webby Award for Best Web Personality for his work on It's Okay To Be Smart.

Joe is also the creator and co-host of Hot Mess, a show about climate change and the environment from PBS Digital Studios.

He received his Ph.D. from the University of Texas at Austin, and his science writing has been published by WIRED, Nautilus, Scientific American and Texas Monthly. One time, he had a Twitter conversation with an astronaut while they were in space. Joe lives in Austin, TX.

2019 Themes

Eye-opening Societal Interventions
Old Problem, New Solution
Myths and Mysteries Unravelled
New Educational Viewpoints
Small Structure with a Big Impact

2019 Program Co-Chairs

Kisha Greer, PhD Candidate in Translational Biology, Medicine, and Health

Sharon Flynn Stidham, PhD Student in Instructional Design and Technology

Day at a Glance:

8:30 to 4:30	Registration	GLC Multipurpose Room
9:00 to 12:00	Research Oral Presentations (15 minute talks)	GLC Rooms C, D
9:00 to 12:00	Flash Talks (5 minute talks)	GLC Room F
12:00 to 1:00	Lunch (Judges, Volunteers, Presenters)	GLC Multipurpose Room
1:00 to 4:00	Research Oral Presentations (15 minute talks)	GLC Rooms B, C, D
2:00 to 4:00	Flash Talks (5 minute talks)	GLC Room F
4:00 to 6:00	Poster Presentations / Reception	GLC Multipurpose Room
6:00 to 7:00	Keynote Speaker: Joe Hanson, MC: Dean DePauw	GLC Auditorium
7:00 to 8:00	Awards Presentation, Dean DePauw	GLC Auditorium

Room details, including locations and times for all speakers follow.

Please note that all times are approximate, and are subject to change.

GLC Conference Room C

9:00 AM	Arit Das	Material Extrusion Based 3D Printing with Blends of Polypropylene and Hydrogenated Resins
9:20 AM	Aarushi Bhargava	Using Sound to Control Drugs Inside our Body
9:40 AM	Jewel Cary	Development of Viral Nanoparticle Delivery System with Polymeric Adjuvants for Vaccine Applications
10:05 AM	Negin Forouzesh	Multidimensional Optimization and Robustness Analysis in the Context of Protein-Ligand Binding
10:25 AM	Kaisen Lin	The Effects of Relative Humidity on the Viability of Infectious Agents and Transmission of Infectious Diseases
10:45 AM	Lehi Dowell	Post Destination Image of the 2016 Rio de Janeiro Olympics: Autonomous Agents and their Cognitive/Affective/Conative Impact on United States Citizens
11:10 AM	Syeed Md Iskander	Reduction in Required Reagents and Sludge Generation in Fenton's Oxidation of Landfill Leachate through Forward Osmosis and Humic Acid Recovery
11:30 AM	Mohammed Almannaa	Can Portable Stations Resolve Bike Share System Station Imbalances?
11:50 AM	Jier Han	Using Multi-walled Carbon Nano-tubes Filler to Enhance Mechanical Properties of Wholly Thermoplastic Composite Materials for Automotive Applications
1:00 PM	Sarah Harrell	Developing High Bridge Trail State Park Conceptual Plan: a New Perspective on Interdisciplinary Learning and Collaboration
1:20 PM	Jack Leff	Enclosable Futures: The Commons, Prison-Time, and Political Economy
1:40 PM	James Schlitt	Optimizing public health opioid messaging with ChatterGrabber Message Mapping
2:05 PM	Ahmed Ghanem	Modeling Instantaneous Cyclist Acceleration and Deceleration Behavior
2:25 PM	Qi Song	Computational Analysis of Gene Regulation in Plants
2:45 PM	Shiqiang Zou	Towards Sustainable Water Reuse: Mitigation of Bidirectional Solute Flux in Forward Osmosis Membrane Process
3:10 PM	Ian Hines	Influence of Host Genetics on the Epithelial-associated Microbiomes in Aquaculture-raised Nile Tilapia (Oreochromis niloticus)
3:30 PM	Sarah Kerrigan	Assessing Mathematical Cognition Behaviorally and Neurologically: Working Memory and Units Coordination Theoretical Framework
3:50 PM	Md Nurul Huda	3D Simulator for ICON MIGHTI Data-Model comparison

GLC Conference Room D

9:00 AM	Sakshi Upadhyay	To join or not to join: Coalition Formation In Public Goods Game
9:20 AM	Grace Wusk	Quantifying Cognitive Workload with Psychophysiology for Spaceflight Applications
9:40 AM	James Budnick	Redefining GABA, from Neurotransmitter to Signaling Molecule for Bacterial Pathogenesis
10:05 AM	Zerin Mahzabin Khan	Therapeutic Focused Ultrasound Stimulated Controlled Release of Nitric Oxide from an Injectable Hydrogel
10:25 AM	Diane Eilerts	Rhythmicity and Oxidative Stress in Aedes aegypti Mosquitoes
10:45 AM	Alissa Hendricks	Determining Dosimetry Metrics for Histotripsy Liver Cancer Ablation: Comparative Study of Histotripsy in Excised Tumor, Liver, and Local Critical Structures
11:10 AM	Wenjun Han	A Connected Work Zone Hazard Detection System for Roadway Construction Workers
11:30 AM	Whitney Woelmer	Analysis of Historical Monitoring Data to Understand Current and Future Dynamics of Harmful Algal Blooms
11:50 AM	Mai Dahshan	Visual Analysis of Scientific Simulation Ensembles
1:00 PM	Rubayet Elahi	Chemo-proteomic Discovery of Putative Lipases in the Asexual Blood Stages of Plasmodium falciparum
1:20 PM	Omchand Mahdu	The Impacts of Climate Change on Rice Production and Small Farmers' Adaptation: A Case of Guyana
1:40 PM	Madeleine Bruce	Large-Scale Evaluation of Infants' Looking Patterns to Dynamic Audiovisual Events
2:05 PM	Callie Zawaski	Using 3D Printing to Embed Liquids into Water Soluble Materials for Timed Release for Pharmaceutical Applications
2:25 PM	Taylan Topcu	Workload Quantification in Socio-technical Infrastructure Management Systems: Human vs. Autonomous
2:45 PM	Alexander Haring	Sensing in 3D Printed Neural Microphysiological Systems
3:10 PM	Catherine Cowan	Autoimmune Inflammation Induces Differentiation of Atypical Immune Cells in the Spleen
3:30 PM	Ubadah Sabbagh	Sweaters for Brain Cells
3:50 PM	Alissa Ganser	Investigations into the Life History of the Tennessee Heelsplitter (Lasmigona holstonia)

GLC Conference Room B

1:00 PM	Maryam Yuhas	Development and Testing of Mobile Phone Short Message Service (SMS) Messages to Reduce Sugar-Sweetened Beverage Intake in Rural Caregivers and Adolescents: A Mixed-Methods Study
1:20 PM	Assad Ullah Khan	Fabrication of Plasmonic Nanoparticle-Polymer Composite Thin-Films for Application in Tinted Glass
1:40 PM	Khadija Rouchdi	Impact of Slow Steaming on U.S. Imports: Does Time Sensitivity Matter?
2:05 PM	Joelle Martin	Sheathing System xc-: The Double-Edged Sword of Glioblastoma
2:25 PM	Michael Edwards	Environmental Exposure to 17α-ethinyl estradiol Augments Kidney Disease and Response to Infections in Female Autoimmune-Prone MRL/lpr Mice
2:45 PM	Holly Packard	Studying Gene Regulators Essential for the Plant Pathogen Pantoea stewartii to Survive in Corn
3:10 PM	Veronica Ringel-Scaia	Towards Reclassifying “Immunogenic Cell Death” as Pyroptosis
3:30 PM	Darcy Davidson	Investigating the Role of Charge-Altering Post-Translational Modifications on Tau Peptide Conformational Ensembles using Polarizable Molecular Dynamics Simulations
3:50 PM	Rebecca Brock	Irreversible Electroporation Stimulates a Pro-Inflammatory Tumor Microenvironment in Pancreatic Cancer

GLC Conference Room F

9:00 AM	Khushboo Gupta	Exploring Risk Co-occurrences in Implementing Smart City Projects in a Developing Nation’s Context
	Arman Izadi	Improvements to the Global Oceanic Model
	Elaine Bradford	Proposed In-Vitro Model of Neutrophil Swarming in a Chronic, Low-level Inflammatory State
	Rachel Rupnow	Math and Metaphors: Images Students Use to Understand Abstract Concepts
	Martina Svyantek	Disability, Accessibility, Research Methods, Researcher Ethics
10:00 AM	Saeed Al Nuaimi	Wireless Data Acquisition System Remote vibration Sensing using Locally-harvested Energy
	Holly Morrison	Noncanonical NF-κB Signaling in Inflammatory Bowel Disease Associated with Anti-TNF Therapy Responsiveness in Human Patients

GLC Conference Room F

10:00 AM, continued	Hanh Le	Spatial Distribution and Temporal Change of a Ruminant-Specific Microbial Marker and Antibiotics in Manure-Amended Soils via Surface Application and Subsurface Injection
	Nesma Osman	Exploring Disabled Agricultural Workers' Professional Life Before and after Using Assistive Technology: Using the Job Characteristics Model
	Bronson Weston	Caulobacter Utilizes Cell Cycle "Checkpoints" to Adapt to Environmental Factors
11:00 AM	Francesca A. Silva Hankins	The Head, The Hand, and The Heart: The Design Philosophy of Bruce Goff
	Elizabeth Shadle	Climate Interactions in a Changing World: Assessing the Effects of Warming and Drought on Amphibian Larvae in an Artificial Pond Experiment
	Gourav Sharma	Role of Epigenetic Modification in Weed Evolution
	Tyler McFayden	Sluggish Cognitive Tempo (SCT) in Autism Spectrum Disorder: Implications for Comorbidity and Social Impairment
	Kathleen Carper	Hybrid: It's Not Just For Cars Anymore. Buckle Up, Academia.
2:00 PM	Jessie Mann	A Clinical Case Series on the Transdiagnostic Application of Acquire Intensive Neuromotor Rehabilitation
	Hazem Sharaf	Towards a Better Understanding of Soybean and its Root Nodules Microbiome
	Lauren Smithee	Impact of Violence, Distress, Discrimination, Support, and Outness on Suicidal Ideation Among Transgender People of Color
	Satyaki Das	Tools for Comparison of ICON EUV Instrument for Different Space Based and Ground Based Proxies
	Kellie King	Discovery of New Regulatory Small RNAs in Brucella abortus
3:00 PM	Soo Jeong Jo	A Framework for Utilization of CFD in the Early Stages of Architectural Design
	David Mercer	The Colored Sense of Awareness: An Analysis of Race, Power, and Communication in the Workplace
	Lauren Bochicchio	STING-Mediated Interferon Response Contributes to Neurodegeneration After Traumatic Brain Injury
	Diana Devine	Mothers' and Fathers' Differential Discussion of Emotion with their School-Age Children
	Albert Raboteau	Attitudes Toward University Communication: Applying and Extending the Theory of Planned Behavior

GLC Multi Purpose Room Poster Presentations

Dhoha Abid	Prediction of Biological Functions from Metagenomic Short Reads Using Domain Signature
Venice Adams	Evaluation Plan for the Recruiting Initiative for Student Engineers Program
Sana'a Al-Rquaibat	A Framework for the Implementation of Digital Technologies in the Concept Stage of the Architectural Design Process
Mohammad Aljamal	Real-Time Estimation of Vehicle Counts on Signalized Intersection Approaches Using Probe Vehicle Data
Dongmei Alvi	Microbial Source Tracking Using Digital PCR To Discriminate Sources of Fecal Contamination in Base Flow of Potomac River
Meghana Cyanam	Modeling the Within-host Infection Dynamics of Malaria
Maha Elouni	Implementation and Investigation of a Weather-tuned Network Perimeter Controller
Nayara Faria	Augmented Reality Head-up Displays Effect on Drivers' Spatial Knowledge Acquisition and Workload
Elisa Gagliano	Consider the Chloroplast: Solanum pennellii Chloroplast Stress Response Highlights Thread of Tomato Clade Evolution
Rachel Hammer	Soil Respiration and Related Environmental and Remotely Sensed Variables under Different Vegetation Types in a High Elevation Southern Appalachian Forest
Ross Hammes	Exploring barriers/drivers in Local Business Participation in Downtown Revitalization
Lindsey Hanks	"Get Lit": An Analysis of the Framing of Party-Schools in the U.S.
Michael Holden	Understanding the Interactions between Development and Nest Depredation in Bog Turtles
Dalya Ismael	Aligning Decision Tools with Cultural Values Through Goal Framing

GLC Multi Purpose Room Poster Presentations

Naree Ketusing	Development of a conceptual framework and assessment tools to assess the Foot and Mouth Disease (FMD) control program in the proposed FMD-free zone in Thailand
Mayank Khurana	Relationship Management in Public Private Partnership Projects: Literature Synthesis and a Path Forward
Rachelle Kuehl	Equity in Children's Audiobooks: Investigating the Whiteness of Six U.S. Library Systems' Offerings
Jiyoung Lee	Comparative Transcriptome Analysis Reveals Conserved Genomic Characteristics of Drought Responsive Genes Across Multiple Plant Species
Yulong Liu	Images, Spatiality and Modernity: An Iconology-framing Analysis on a Visual Consumerism Case
Ayeshan Mahendra	Secondary Cell Wall Associated Transcription Factors Popnac154 and Popnac156 Regulate Leaf Senescence and Growth Responses to Nutrient Availability
Claire Marik	Growth and Survival of Listeria Monocytogenes on Intact Fruit and Vegetable Surfaces: A Systematic Review
Rachel Nelson	Cultivating a Healthy School Environment: Evaluation of a Training for Virginia School Nutrition
Alexa Salsbury	Polarizable Molecular Dynamics Simulations of c-kit Oncogene Promoter G-Quadruplexes of Distinct Conformations
Blake Sanders	FusoPortal: An online database of Hybrid MinION sequenced, assembled, and functionally annotated Fusobacterium genomes
Joseph Sarver	A New Twist on Polymer Characterization
Rachana Deven Somaiya	Can the Eye Tell Cells in the Brain Where to Go?
Amanda Wei	Inverse Design of 3D Ferroelectric Lattice Materials with Arbitrary Combinations of Piezoelectric Coefficients
Kelsey Wooten	Gender Representation in Sports Illustrated for Kids

Prediction of Biological Functions from Metagenomic Short Reads Using Domain Signature

Dhoha Abid, Poster Presentation, GLC Multipurpose Room

Authors: Dhoha Abid, Liqing Zhang

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Keywords: Metagenomics analysis, fast protein prediction

Metagenomic sequencing and analysis is known as the genomic study of the microbes in their environment. In the past decade, this field gained unprecedented attention as it enables characterization of the vast diversity of microbes that could not be or have not been cultured in the lab. Indeed, metagenomic studies have elucidated how microbes modulate and maintain the atmosphere and how they play an essential role in human health. A major task of metagenomic studies is the prediction of protein functions of a given metagenomic sample. Depiction of protein functions provides insight into the biological role of the microbes. A commonly used approach is to assemble short reads into longer contigs, identify open reading frames, and finally predict protein function. This approach is both slow and prone to errors as assembly is inherently time consuming and can generate chimeric contigs. Here we propose a faster approach that eliminates the assembly step. Specifically, we determine the functional composition of a metagenomic sample by predicting the domain signature of short read sequences. Domains are short substrings of protein sequences, dictating the function of the whole protein sequences, and have a comparable lengths to the reads, which enables us to predict domain directly from the metagenomic DNA reads with no assembly step. Towards this end, we trained a deep learning model using protein sequences translated from DNA reads. We used kmer features of sizes 1, 2, and 3; and assessed our model using simulated data. Results show that the our model can predict DNA reads to their corresponding domain signature with an accuracy of 77%, demonstrating the great promise of our approach as a fast yet accurate alternative for function prediction in big metagenomic data. Future work will include more extensive model training and evaluation using both simulated and real data.

Evaluation Plan for the Recruiting Initiative for Student Engineers Program

Venice Adams, Poster Presentation, GLC Multipurpose Room

Authors: Venice Adams, Dan Li, Tami Amos

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Keywords: Formative Evaluation, Engineering Program, Pre-College Initiative, Logic Model

The Recruiting Initiative for Student Engineers (RISE) is a program hosted by the Center for the Enhancement of Engineering Diversity (CEED) at Virginia Tech aimed at increasing the diversity of the engineering professional community. RISE strives to improve access to Virginia Tech by removing barriers that may prevent underrepresented students from visiting campus. The program has five main goals: 1) increase the diversity of students who apply to, enroll, and graduate from the College of Engineering; 2) increase the awareness of engineering and other technical fields as an exciting and rewarding career path to a diverse population; 3) provide academic, professional and personal support programs; 4) provide support to student organizations that support our mission, including the National Society of Black Engineers, the Society of Hispanic Professional Engineers, the Society of Women Engineers, and Council for the Advancement of Minority Engineering Organizations; and 5) foster collaboration between the CEED, the University, industry, and the local community. The purpose of this formative evaluation is to describe the RISE program, develop a logic model for key stakeholders, and construct a timeline for conducting the evaluation. The researchers met with stakeholders from the CEED office to better understand the needs of the program, identify existing standards, and review previous procedures. Using a logic model, the researchers frame the program's inputs, outputs, and impacts. The results describe the program's short-term, middle-term, and long-term goals ranging from one to five years.

Wireless Data Acquisition System Remote vibration Sensing using Locally-harvested Energy

Saeed Al Nuaimi, 10:00 AM Flash Talk Round, GLC Conference Room F

Authors: Saeed Alnauimi, Manish Singh, Dr. Muhammad R. Hajj

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Keywords: Smart sensors, Water grid systems, Self-powered sensors, Micro hydro turbine, Flow meter, Energy harvesting, Advanced metering infrastructure, Internet of Things

Effective sensing of environmental parameters or conditions rely on wireless connectivity of spatially distributed autonomous sensors to acquire and transmit data to a main location. To date, the majority of sensing and wireless transmission devices rely on wired connections or batteries that require periodic replacement, which is not entirely true to the concept of an autonomous embedded sensing network. Advances made towards the development of low-power microcontrollers, sensing devices and ultra low-power wireless technologies open the opportunity for substituting depletable batteries with low levels of locally-harvested kinetic, light, or thermal energy to power the sensing and transmission functions of a network. We establish a self-powered real-time point-to-point wireless communication system between a vibration sensor and transmission and receiving modules. The sensing device and transmission module are powered by a vibrating object using a piezoelectric energy harvester. The harvested power is then used to power a vibration sensing device and the transmission of the acquired signal during other periods.

A Framework for the Implementation of Digital Technologies in the Concept Stage of the Architectural Design Process

Sana'a Al-Rquaibat, Poster Presentation, GLC Multipurpose Room

Author: Sana'a Al-Rquaibat

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Keywords: Digital tools, Design process, Concept stage

The use of digital tools is now commonplace in the architectural design process. These tools have advantages for time management and support the iterative nature of designing while providing an efficient connection to later stages of design development and construction documentation. However, the use of digital tools during the concept phases of designing limits the cognitive connection between thought and hand that is present in freehand sketching, therefore, a digital sketching tool is needed that have features similar to freehand sketching while processing the sketches to 2D and 3D representations that are translatable to 3D printing and Building Information Modeling. The purpose of this research is to identify the characteristics of the next generation of sketching tools to support ideation activities in the concept stage. The results will help to design a roadmap for the implementation of digital technologies in the architectural design process. The results will be used to implement digital technologies in design education. This research will contribute to a shift in the implementation of digital tools in the architectural design process. This research relied on multiple data sources. First, a logical argument tactic was used to develop the research design model through a comprehensive review of the scholarly work that addressed the design process and the role of sketching and digital tools throughout these processes. Second, case study observation and interviews were used to explore how architects and architectural students at Virginia Tech use sketching, 3D modeling, and existing digital tools to represent, develop, iterate, and communicate their design ideas in the concept stage and how the tools they used affect their design process. Third, immersive case studies were conducted to identify and develop the characteristic of the digital sketching tool. The last was to determine the consensus for the appropriateness of the tool through Delphi tactics.

Real-Time Estimation of Vehicle Counts on Signalized Intersection Approaches Using Probe Vehicle Data

Mohammad Aljamal, Poster Presentation, GLC Multipurpose Room

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Keywords: Real-Time Estimation, Kalman filter, Probe Vehicles

This paper presents a novel method for estimating the number of vehicles traveling along signalized approaches using probe vehicle data only. The proposed method uses the Kalman Filtering technique to produce reliable vehicle count estimates using real-time probe vehicle estimates of the expected travel times. The proposed method introduces a novel variable estimation interval that allows for higher estimation precision, as the updating time interval always contains a fixed number of probe vehicles. The proposed method is evaluated using empirical and simulated data, the former of which were collected along a signalized roadway in downtown Blacksburg, VA. Results indicate that vehicle-count estimates produced by the proposed method are accurate, especially when the probe vehicle market penetration rates are 20% and higher. The paper also examines the model's accuracy when installing a single stationary sensor (e.g., loop detector), producing slight improvements especially when the probe vehicle market penetration rate is less than 20%. Finally, the paper investigates the sensitivity of the estimation model to traffic demand levels, showing that the model works better at higher demand levels given that more probe vehicles exist for the same market penetration rate.

Can Portable Stations Resolve Bike Share System Station Imbalances?

Mohammed Almannaa, 11:30 AM, GLC Conference Room C

Authors: Mohammed Almannaa, Mohammed Elhenawy, and Hesham Rakha

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Keywords: rebalancing, bike-sharing system, simulation, portable stations

The notable increase in bike-sharing systems (BSS) is accompanied by daily logistical challenges. Stations that are empty or full during the day reduce BSSs efficiency and make it inconvenient for bikers to rent or return a bike without altering their origin or final destination. Previous studies have proposed solutions using either overnight or daytime approaches, which assume imbalanced stations are served by a fleet of trucks either during or at the end of the day. Both approaches also assume the location and number of bike stations are fixed and only the bikes can be moved. Here, we propose a new rebalancing approach using portable stations that can either be standalone or an extension of existing bike stations. This approach has the ability to accommodate the dynamic change of trip distributions, allowing BSSs to accommodate dynamic demand over time without changing the infrastructure, resulting in a less-cost-and-effort solution. We propose using an agent-based simulation approach as a proof-of-concept. The simulated BSS was calibrated using a dataset collected from 2013–2015 in the San Francisco Bay area. Results showed that adding one portable station to a 35-station network could lower missed bike pick-ups by 10%, leading to increased user satisfaction and reducing repositioning/rebalancing operations. Sensitivity analysis showed that adding one more portable station could reduce the percentage of missed bike pick-ups to almost 25% and on the repositioning operation as much as three times.

Microbial Source Tracking Using Digital PCR To Discriminate Sources of Fecal Contamination in Base Flow of Potomac River

Dongmei Alvi Poster Presentation, GLC Multipurpose Room

Authors: Dongmei Alvi, Alex Clare, Adil, Godrej

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Keywords: digital PCR, bacteroide markers, assay

Persistent and ongoing problems with fecal contamination of recreational water has led to a ban imposed by District of Columbia Department of Health on swimming in all rivers and creeks in the District of Columbia- especially those in contact with water bodies immediately downstream of any combined sewer overflow (CSO) discharge. In order to discriminate hosts of fecal contamination either from human or ruminant animals, a digital PCR (dPCR) methodology was developed for Potomac River sampling site on the border of Washington DC and Virginia State. Three genotypic bacteroide markers of humans (HF183, BacH) and ruminants (BacR) were investigated using chip based dPCR technique for bi-weekly base flow samples. Thermo cycles of all bacteroide markers in this study were optimized by screening marker specific annealing temperature, sensitivity and specificity of all markers were assessed as well. The single digit gene copy per chip-reading was achieved, but did not quantify for reporting as a positive contamination. In addition, dPCR TaqMan assay showed consistent resistance to matrix inhibition toward very complex samples from wastewater treatment plants. The bacteroide markers were further evaluated with culture based Escherichia coli analysis by IDEXX colilert. Our results indicate that outbreaks of human related fecal contamination are mostly related to storm events, whilst prominent source of ruminant fecal contamination were observed throughout base flow sampling events. Levels of both bacteroides markers agree tendency of E.coli in summer season, whilst no clear correspondence was observed for winter season monitored. This study concluded that dPCR TagMan assay could potentially be a viable tool for MST monitoring.

Using Sound to Control Drugs Inside our Body

Aarushi Bhargava, 9:20 AM, GLC Conference Room C

Author: Aarushi Bhargava

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Keywords: drug delivery, sound actuation, polymer capsules

Targeted and controlled medication are two of the main pillars for efficient drug delivery to treat life-threatening diseases. Current method of taking medicines by ingestion faces two major challenges; 1) early release of drugs inside body affecting the uninfected organs and 2) multiple dosages of the medicine due to small amount of drug reaching the target location thus, increasing the side effects. In this research, we leverage experimental, analytical and computational techniques of using polymers which can deliver drugs at the precise infected location based on the requirement of the diseased organ. These polymers are smart materials that have the ability to “hear” sound and change shape so as to release the drug trapped inside them. We use non-invasive and biomedically safe focused ultrasound as a sound trigger. The mechanism involves externally sent sound signal that activates these polymers placed inside the body about the exact location and amount of dosage of drugs, which otherwise remains enclosed within a polymer capsule without harming healthy organs. By controlling the amount and the location of drug delivery, we are able to mitigate the two major challenges faced in drug delivery, which can be severe in case of diseases such as cancer among others. Experiments are further constructed to structurally and geometrically optimize these polymer capsules for better control and flexibility to the user.

STING-Mediated Interferon Response Contributes to Neurodegeneration After Traumatic Brain Injury

Lauren Bochicchio, 3:00 PM Flash Talk Round, GLC Conference Room F

Authors: Lauren Bochicchio, Elizabeth Kowalski, John Chen, Rachana Somaiya, Michelle Theus, & Alicia Pickrell

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Keywords: Neuroscience, traumatic brain injury

Traumatic brain injury (TBI) affects 5.3 million Americans and is a leading cause of death and disability; yet, relatively little progress has been made in alleviating the degeneration of neurons after the initial incident. Inflammation is a key aspect contributing to neuron death post-injury. When immune cells detect damaged or infected tissue, a Type I interferon response helps recruit other immune cells to fight off the danger by stimulating genes in the immune system (interferon-stimulated genes, ISGs). While an inflammatory response is important for clearing damaged tissue debris and infections, sustained inflammation in the brain is harmful. We hypothesized that an overactive immune system stimulating the ISG response contributes to neuron death after TBI. We temporally profiled the immune response in a mouse model of TBI. TBI-injured mice showed an abnormal upregulation of ISGs at 2 and 24 hours after injury compared to sham controls. When STING, a key mediator of this ISG response, was knocked out in mice (and therefore unable to upregulate the Type I interferon response), lesion size was significantly decreased 24 hours after injury. We profiled the ISG response in these STING knockout mice and observed an attenuation, meaning that the inflammatory response was reduced. This suggests that the ISG immune response contributes to the damage after injury rather than helping to repair brain tissue. Our data also suggests that injured mitochondria may be the key activator in stimulating this response. New small molecules developed to inhibit the STING protein may be a possible new therapeutic target to decrease inflammation after TBI. Our study suggests that characterizing this response will be beneficial to TBI patients.

Proposed In-Vitro Model of Neutrophil Swarming in a Chronic, Low-level Inflammatory State

Elaine Bradford, 9:00 AM Flash Talk Round, GLC Conference Room F

Authors: Elaine Bradford, L. Li, L.

Corresponding Author Contact Information: elaineab@vt.edu

Keywords: Cancer, Immunology, Electroporation, Biomedicine

Pancreatic cancer is a major cancer with only 6% of patients surviving past 5 years. With severe lack of viable treatment options due to the localization of the primary tumor as well as the highly immunosuppressive nature and metastatic potential of pancreatic cancer, the development of new ablative (or tumor removal) techniques is critical. Non-thermal irreversible electroporation (IRE) uses short, high frequency electrical pulses to create pores in cancer cell membranes and elicit cell death. IRE has shown promising results in clinical trials and is being fast-tracked by the FDA for pancreatic cancer treatment. However, how IRE causes cell death biologically and its affects in the body are still not know. Here we utilize several cell, tumor, and mouse models of pancreatic cancer to determine the effects of IRE on cell death pathways, cancer pathways, and immune signaling. By using various biological assays to assess pancreatic cancer cells and tumor tissue, we have found that IRE induces inflammatory cell death in mouse and human patient-derived xenograft models. This pro-inflammatory environment can stimulate anti-tumor immune cells to the tumor site, halting tumor progression. Moreover, a non-thermal ablative approach also preserves cancer cell proteins, increasing immune memory against reoccurrence and metastasis. With the advent of these new techniques, the impact of such technologies to the tumor and immune system need to be assessed to determine their clinical application. IRE is proving to be a safe and effective treatment for pancreatic cancer as it not only ablates the primary tumor site but also stimulates the immune system to recognize and combat the tumor throughout the body.

Irreversible Electroporation Stimulates a Pro-Inflammatory Tumor Microenvironment in Pancreatic Cancer

Rebecca Brock, 3:50 PM, GLC Conference Room B

Authors: Rebecca M. Brock, Natalie White, Veronica M. Ringel-Scaia, Sheryl Coutermarsh-Ott, Jenna Cotouri, Rafael V. Davalos, Irving C. Allen

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Keywords: Cancer, Immunology, Electroporation, Biomedicine

Pancreatic cancer is a major cancer with only 6% of patients surviving past 5 years. With severe lack of viable treatment options due to the localization of the primary tumor as well as the highly immunosuppressive nature and metastatic potential of pancreatic cancer, the development of new ablative (or tumor removal) techniques is critical. Non-thermal irreversible electroporation (IRE) uses short, high frequency electrical pulses to create pores in cancer cell membranes and elicit cell death. IRE has shown promising results in clinical trials and is being fast-tracked by the FDA for pancreatic cancer treatment. However, how IRE causes cell death biologically and its affects in the body are still not know. Here we utilize several cell, tumor, and mouse models of pancreatic cancer to determine the effects of IRE on cell death pathways, cancer pathways, and immune signaling. By using various biological assays to assess pancreatic cancer cells and tumor tissue, we have found that IRE induces inflammatory cell death in mouse and human patient-derived xenograft models. This pro-inflammatory environment can stimulate anti-tumor immune cells to the tumor site, halting tumor progression. Moreover, a non-thermal ablative approach also preserves cancer cell proteins, increasing immune memory against reoccurrence and metastasis. With the advent of these new techniques, the impact of such technologies to the tumor and immune system need to be assessed to determine their clinical application. IRE is proving to be a safe and effective treatment for pancreatic cancer as it not only ablates the primary tumor site but also stimulates the immune system to recognize and combat the tumor throughout the body.

Large-Scale Evaluation of Infants' Looking Patterns to Dynamic Audiovisual Events

Madeleine Bruce, 1:40 PM, GLC Conference Room D

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Keywords: Infant, Attention, Eye-tracking, Dynamic

Social attention during infancy has important implications across developmental domains. Research has shown that when looking at static faces, infants typically attend more to the eyes than to other facial areas (e.g., the mouth). However, static faces are limited in their ability to represent the everyday social interactions infants naturally encounter. Thus, our lab sought to examine infants' social attention patterns using dynamic presentations of speakers. Methods: A cross-experimental analysis of scanning patterns across multiple studies involving 103 infants (11-15 months) was conducted. Each infant observed visually dynamic presentations of a female speaker in an infant-directed style (using a Tobii-T60 eye-tracker). Infants experienced trials where the voice track a) aligned with the speakers' movements (congruent), b) did not align with the speakers' movements (incongruent), and c) was not played (silent). The areas of interest (AOIs) included the eyes and the mouth regions. Results: During congruent trials, infants looked significantly more at the mouth ($F(1,102)=7.33$, $p=.008$; $\eta p2=.07$); 62% showed more attention to the mouth region. During silent trials, no differential attention to eye v. mouth region was seen ($F(1, 35)=.79$, $p=.38$; $\eta p2=.02$), and for incongruent trials, infants attended more to the eyes ($F(1,11) =13.25$, $p=.004$; $\eta p2=.55$). Conclusion: In normal interactions, attention to the mouth is high and not driven purely by movement. We interpret this pattern as indicative of infants' emergent sensitivity to social cues and their relevance for directing/maintaining attention.

Redefining GABA, from Neurotransmitter to Signaling Molecule for Bacterial Pathogenesis

James Budnick, 9:40 AM, GLC Conference Room D

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Keywords: GABA, Brucella, bacterial pathogenesis

Gamma-aminobutyric acid (GABA) is one of the most well studied neurotransmitters in the brain. Most people don't realize that while GABA acts as an important inhibitory neurotransmitter, this amino acid plays many functional roles in animals, plants, and bacteria. In plants, GABA is an important part of the immune system with antimicrobial properties and is excreted when the plant is wounded or under stress. In vertebrates, GABA is the most abundant inhibitory neurotransmitter of the central nervous system. Recent studies have revealed that macrophages, primary immune cells, synthesize and catabolize GABA as a means of cell-cell communication; however, the exact role of GABA in vertebrate immunity is still largely unknown. In bacteria, GABA transport has been shown in Agrobacterium tumefaciens and Pseudomonas aeruginosa but questions still remain as to why this occurs and how these microbes utilize GABA. Can bacteria utilize GABA as an energy source, or could it be an important signaling molecule during pathogenesis? Brucella spp. are facultative intracellular bacterial pathogens that colonize and invade macrophages of the host during infection. The ability of the bacteria to invade and form its replicative niche in the macrophage is dependent upon the bacterium's ability to sense its surroundings and quickly regulate its virulence genes to subvert host defenses. We hypothesize that GABA acts as a host signal that Brucella detects in order to adapt to the host environment and allow for successful colonization. Our results lead us to believe that Brucella relies on host derived GABA during pathogenesis. To our knowledge, the ability of bacteria to use GABA as a means of host recognition is not well described. Additionally, this study could have significant implications not only in our understanding of Brucella pathogenesis, but also of other human pathogens that may also utilize GABA during infection.

Development of Viral Nanoparticle Delivery System with Polymeric Adjuvants for Vaccine Applications

Jewel Cary, 9:40 AM, GLC Conference Room C

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Keywords: Nanovaccine, polymeric adjuvants, interdisciplinary

New vaccination technology development has been hindered by lack of adjuvants to enable oral delivery. Adjuvants are substances that stimulate the immune system to both recognize a pathogen like a virus and respond to protect the body from disease. An oral adjuvant killed virus vaccine would have convenient water delivery and avoid the mild infections associated with weakened, live virus vaccines. As similar vaccine technology is used for both humans and animals, for proof-of-concept two poultry viruses of economic interest were chosen as candidates for nanoparticle vaccine formulations: turkey hemorrhagic enteritis virus (HEV) and chicken fowlpox virus (FP). Each virus was encapsulated in gelatin-chitosan nanoparticles (HEV-GC NPs and FP-GC NPs, respectively) using two-step desolvation and assessed in vitro on susceptible poultry cell lines. Viral nanoparticle size, size distribution, and particle charge as measures of stability were assessed using dynamic light scattering. Real-time polymerase chain reaction (qPCR) was performed to determine the number of infectious virions used in the HEV encapsulation as well as to prove inability of the killed HEV virus to replicate. Virus encapsulation and cellular uptake of viral nanoparticles were visualized using transmission electron microscopy (TEM) and confocal microscopy. Dynamic light scattering analysis indicated the viruses were successfully encapsulated in gelatin-chitosan nanoparticles. qPCR revealed 1.01 x 10^4 infectious HEV virions were used in the HEV-GC NP fabrication and suggested fixative at 0.1% by volume or less is sufficient to kill virus for vaccine formulations. TEM confirmed encapsulation and showed cellular uptake within 1 hr of exposure along with confocal microscopy. These results constitute proof-of-concept and justify in vivo trials to assess the ability of the formulations to induce antibody production and protective immunity.

Autoimmune Inflammation Induces Differentiation of Atypical Immune Cells in the Spleen

Catharine Cowan, 3:10 PM, GLC Conference Room D

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Keywords: autoimmune, lupus, neutrophils, immunology

The immune system is comprised of multiple cell populations which each play their own role in the coordinated defense against disease. In a normal immune system response, different cell types act in identifying a pathogen, alerting the rest of the system, attacking the “invader” and clearing it, then ordering a retreat to return the body to equilibrium. Occasionally this defense system goes awry and attacks its host, resulting in auto-immune diseases such as lupus. Since the immune system mistakenly identifies the body’s own tissue as an “invader”, this leads to perpetual activation and chronic cycles of inflammation, altering communication between cell types and leading to aberrant responses. We have found that one cell type, neutrophils, appear to take on a very different role in mouse models of lupus. Long considered the foot soldiers of the immune system, these cells normally circulate and quickly respond to pathogens by release of sticky DNA traps, destructive enzymes and reactive oxygen bursts. They were not thought to play a role in alerting the rest of the immune system to specific pathogens, a process called antigen presentation, nor in modulating other cell development in immune organs such as the spleen. In lupus however, we have found increased numbers of neutrophils in the spleen which upregulate expression of proteins involved in antigen presentation such as MHC II, and pro-inflammatory cytokines such as IL-1□ and IL-17. These atypical neutrophils may come from increased hematopoietic stem cells in the spleen, activated by the chronic inflammatory state found in lupus. The abnormal inflammatory state also alters the microenvironment around progenitors differentiating into mature neutrophils which we believe accounts for their unusual protein expression and function. Thus, in a cyclical way, the chronic inflammatory state found in autoimmune disease produces atypical cell populations which further promote the disease.

Modeling the Within-host Infection Dynamics of Malaria

Meghana Cyanam, Poster Presentation, GLC Multipurpose Room

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Keywords: Mathematical Modeling, Malaria

Malaria is a key, vector-borne illness which poses a significant threat to human and animal health. Malaria within humans is transmitted by the bite of female Anopheles mosquitoes infected with Plasmodium parasites. While several strains of Plasmodium are known to cause human illness, the vast majority of human morbidity and mortality is caused by P. falciparum, resulting in an estimated 200 million global infections per year. P. falciparum has demonstrated a notable ability to evade host immune systems and persist in populations via antigenic variation. In this study, we built a within-host model of interaction dynamics between a single human immune system and Plasmodium parasites. Host immunity, parasite replication, antigenic variation, and immune evasion were simulated using MATLAB. Future work will seek to extend this individual based model within an agent-based model to predict the efficacy and efficiency of intervention programs such as vaccination.

Visual Analysis of Scientific Simulation Ensembles

Mai Dahshan, 11:50 AM, GLC Conference Room D

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Keywords: Visual Analytics, Scientific Visualization,Simulation Ensemble, Sensemaking

Recent advancement in computing power and storage enabled scientists to run multivariate complex physical simulations. As scientists seek to understand the uncertainty and relationships among multiple attributes, they run their simulation multiple times with different initial settings in what is known as 'ensemble'. Simulation ensemble help scientists in quantifying the variability of the output with respect to a range of initial conditions, exploring unknowns in initial conditions, evaluating extreme cases, and comparing structural characteristics of their models. To capture the changes and differences among ensemble members, scientists use visualization and analysis approaches. However, most of these approaches either visualize a statistically aggregated version of data leading to the loss in information or analyze the relationships between either the ensemble members or output parameter space while neglecting the effect of input parameters and human in the analysis loop. In order to understand the connections between simulation parameters and patterns in the output data, we have been developing an approach to the visual analysis of scientific data that merges human expertise and intuition with machine learning and statistics allowing scientists to explore, search, filter, and make sense of their multivariate ensemble. Our approach is manifested in a new multi-view visualization tool, GLEE (Graphically-Linked Ensemble Explorer), where each view offers different functionality for exploration and interoperation of the relations and correlations between ensemble members, input and output parameters. Our tool uses visualization and semantic interaction techniques to enable scientists to: find similarities and differences between runs, find correlations between different parameters, and explore relations and correlations between different runs and parameters. Our approach supports scientists in selecting interesting subsets of runs to investigate and summarizing factors and statistics to show variations and consistencies across different runs. We evaluate our tool with experts to understand its strength and weaknesses for optimization and inverse problems.

Material Extrusion Based 3D Printing with Blends of Polypropylene and Hydrogenated Resins

Arit Das, 9:00 AM, GLC Conference Room C

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Keywords: keywords

In spite of notable development in the 3D printing processes, there are currently only a handful of materials that can be printed consistently. Polypropylene (PP) has been used in a wide range of applications because of its remarkable physical, mechanical, chemical and optical properties. The fast crystallization behavior of PP can be efficiently managed using traditional processing techniques like extrusion and injection molding. However, with respect to 3D printing the fast crystallization results in rapid volumetric contraction that causes shrinkage and warpage of the manufactured parts which in turn leads to poor dimensional stability. Moreover, unlike injection molding, the mechanical properties of the parts obtained by 3D printing are often inferior to that of the bulk material due to the anisotropic nature of the printed parts. The goal of our work is to enable printing of PP with mechanical properties and quality approaching injection molded PP thereby reducing the production time and costs significantly. We present the effects of two different low molecular weight hydrogenated resins on the thermal behavior and crystallization of PP blends. The incorporation of resins to the pure PP matrix lowered the crystallization temperature of PP from 121°C to 116°C which enabled additional diffusion during the solidification process. The combined modifications in crystallization rates and times significantly impacted the adhesion between the deposited layers which directly affected the mechanical properties and part warpage. The tensile modulus for the printed 80/20 blend was 893 MPa which was higher than that of printed PP part (871 MPa). The reason for this behavior was attributed to a combination of changes in the crystallinity, morphology, and improved interlayer adhesion during printing. We can leverage these results to modify the processing conditions in order to optimize the mechanical properties of the parts generated using 3D printing.

Tools for Comparison of ICON EUV Instrument for Different Space Based and Ground Based Proxies

Satyaki Das, 2:00 PM Flash Talk Round, GLC Conference Room F

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Keywords: ICON, EUV, NASA

The ionosphere is the ionized part of Earth's upper atmosphere, from about 60 km to 1,000 km altitude, a region that includes the Thermosphere and parts of the Mesosphere and Exosphere. In this region at about 150 kilometers above the surface of the earth starts the F region and it extends up to 500 kilometers. In this region, the tenuous gases are anything but quiet, as a mix of neutral and charged particles travel through in giant winds. These winds can change on a wide variety of time scales -- due to Earth's seasons, the day's heating and cooling, and incoming bursts of radiation from the sun. In order to study the behavior of these ions and understand this complicated region, NASA has developed the ICON mission. The satellite consists of four major instruments which are IVM, EUV, FUV and MIGHTI. This work is concentrated on the EUV instrument which measures the ionized oxygen densities in the F region of the Ionosphere. Different atmospheric model including the IRI and TIEGCM, along with data obtained from ground-based observations and the ICON FUV instrument will be compared to the ionized oxygen profile, NmF2, HmF2 and various other parameters that are obtained from the EUV.

Investigating the Role of Charge-Altering Post-Translational Modifications on Tau Peptide Conformational Ensembles using Polarizable Molecular Dynamics Simulations

Darcy Davidson, 3:30 PM, GLC Conference Room B

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Keywords: Amyloid, Disease, Computational Biochemistry

Protein aggregation is the hallmark of amyloid diseases such as Alzheimer's, Type II Diabetes, Parkinson's and more. There are no cures for any of these diseases and the underlying causes remain unknown. Amyloidogenic proteins unfold, aggregate, and self-assemble into highly stable, insoluble, toxic fibrils. Despite having unique primary sequences, these amyloidogenic proteins all undergo similar structural changes, from disordered and only partially structured, to highly ordered in the fibril form. The driving forces of these changes in structure are not completely characterized; a better understanding is needed to combat the wide range of diseases that are chronic and debilitating. Specifically, Alzheimer's Disease (AD) affects millions of people worldwide and is the 6th leading cause of death in the United States. AD is characterized by two toxic protein aggregates: amyloid-b plaques outside brain cells and Tau deposits inside brain cells. In this study, we performed computer simulations with a novel physical model to gain a better understanding of protein aggregation. We previously found that electronic polarization (the ability of a molecule's electronic structure to change in response to its environment) is required to delineate mutation-specific unfolding pathways of amyloid-b. Building upon those findings, here we explore the impact of charge-altering post-translational modifications (PTMs) on the dynamics of Tau. PTMs are known to induce Tau aggregation, but the underlying molecular mechanisms are unknown. By studying fragments of Tau harboring these PTMs, we sought to gain novel insights into how changes in charge cause Tau to change its shape and ultimately aggregate. Our simulations of these charge-altering PTMs shed light on how interactions among charged amino acids (the building blocks of proteins) affect the structure of tau and contribute to its aggregation potential. The simulations provide insights into druggable targets and a fundamental understanding of how proteins fold.

Mothers' and Fathers' Differential Discussion of Emotion with their School-Age Children

Diana Devine, 3:00 PM Flash Talk Round, GLC Conference Room F

Authors: Devine, D., Smith, C. L., Dunsmore, J. C., & Bradburn, I.S. (2019). Mothers' and Fathers' Differential Discussion of Emotion with their School-Age Children. Oral Presentation to be given at Graduate Student Assembly Research Symposium and Exposition, Virginia Tech, Blacksburg, VA.

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Keywords: middle childhood, parental emotion socialization, sex differences

Parental socialization of emotions has been a topic of interest in developmental research for decades because of the importance of understanding how children learn about their emotions. The influence of the sex of both parent and child, however, are often not considered, and research on parent emotion socialization has often focused on infants and young children. Not considering these constructs during middle childhood ignores the importance of this developmental period, during which children have a more established gender identity and thus might recognize a shared identity with a parent. Emotion socialization from both parents during this developmental period has the potential to differentially inform children's expectations of gender norms related to emotions. Men and women interpret and express their emotions differently and may differentially socialize their children regarding emotions along these patterns. The current study examined parental emotion coaching and elaboration observed during discussions of positive and negative emotions between 44 children with their mothers and fathers, with specific focus on the sex of the parents and children. I expected that mothers would engage in more emotion coaching and use a more elaborative style than fathers. Additionally, I expected that parents of girls would be more encouraging of positive emotions than parents of boys and that parents of boys would be more discouraging of negative emotions than parents of girls. Children between the ages of 6 and 9 visited the Children's Emotions Lab with their mothers and fathers on separate occasions and participated in an emotion talk task with each parent. Each pair discussed a time when the child was happy and a time when the child was upset; each discussion lasted two and a half minutes each. I found a significant emotion valence by child sex interaction: parents were more elaborative and encouraging when discussing positive emotions with daughters than with sons and that parents were more elaborative and encouraging when discussing negative events with sons than with daughters. There was also specific parent gender by child sex interaction: mothers were less elaborative and encouraging with daughters than sons and that fathers were less elaborative and encouraging with sons than daughters. Findings from this study suggest that parents' experiences with their own emotions influence their emotion socialization practices with their children. Recommended practices for future studies and interventions are suggested.

Post Destination Image of the 2016 Rio de Janeiro Olympics: Autonomous Agents and their Cognitive/Affective/Conative Impact on United States Citizens

Lehi Dowell, 10:45 AM, GLC Conference Room C

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Keywords: Destination Image

This quantitative study examined autonomous agents (news broadcasts) and their impact on Americans who watched coverage of the 2016 Rio Olympic Games. Participants' post destination images were evaluated using cognitive, affective (unpleasant-pleasant, distressing-relaxing, sleepy-arousing, gloomy-exciting), and conative (intent to travel) attributes. In addition, a section for altruistic purposes was added to see how a factual statement regarding the negative impacts of the Olympics might influence future behavior. Image formation theory has been studied for nearly seven decades. Boulding (1956) completed primary studies in the context of factual cognitive reasoning. Scott (1965) more clearly defined cognitive image as an evaluation of the known attributes of the product or the understanding of the product in an intellectual way. Crompton (1979) elucidated destination image as "the sum of beliefs, ideas, and impressions that a person has of a destination". According to Dobni et al (1990), image is a perceptual phenomenon that is formed through consumers' reasoned and emotional interpretation, and, has both cognitive (beliefs) and affective (feelings) components. Gartner (1993) further enhanced tourism literature with an interrelated causal model identifying cognitive (intellectual), affective (motivational), and conative (action) correlations. Within this study, he identified autonomous image formation agents as news reporting organizations and popular culture. Autonomous agents have significant impacts on tourism image development due to high credibility and market penetration. Agapito et al. (2013), tested Gartner's theoretical model with a confirmatory analysis study, which provided positive validation. The study I completed was a continuation of Agapito's research in order to see if the theoretical model set forth by Gartner could be expanded to incorporate future intent to travel to a new location based upon exposure to autonomous agents.

Environmental Exposure to 17α-ethinyl estradiol Augments Kidney Disease and Response to Infections in Female Autoimmune-Prone MRL/lpr Mice

Michael Edwards, 2:25 PM, GLC Conference Room B

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Keywords: Estrogen, Lupus, TLR7, TLR9

Human activities have led to the accumulation of estrogenic endocrine disrupting chemicals (EDCs) in multiple ecosystems, leading to unintended environmental exposure by wildlife and humans. 17α-ethinyl estradiol (EE), a synthetic estrogen similar to the estrogen made in the body, is used commonly in contraceptives and hormone replacement therapies. EE accumulates in aquatic ecosystems and soil, often through sewage effluents. Estrogens have been shown to alter the immune system in multiple mouse models of disease and in human patients. Infections and kidney failure are two of the leading causes of death in systemic lupus erythematosus patients. Though humans are commonly exposed to EDCs, few studies have investigated the immune-related effects following chronic low-dose exposure to EE. In this study, we orally exposed autoimmune-prone female mice to a human-relevant environmental exposure dose of EE and evaluated autoimmune disease parameters, kidney disease, and response to viral and bacterial infection models. EE-exposed mice had higher levels of a lupus marker in early disease, and increased clinical signs of renal failure throughout the study. When evaluating response to infection models, EE-exposed mice showed an impaired ability of immune cells to communicate and respond to infections. Taken together, our data shows that chronic low-dose oral exposure to EE will exacerbate clinical renal disease and suppress the immune response to infections in the MRL/lpr mouse model. By understanding how estrogenic EDCs change the response of the immune system to both internal and external challenges, new preventive strategies and therapies can be developed.

Rhythmicity and Oxidative Stress in Aedes aegypti Mosquitoes

Diane Eilerts, 10:25 AM, GLC Conference Room D

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Keywords: Mosquitoes, Oxidative stress, Circadian rhythms

Mosquito bites resulting in disease transmission contribute to over 1 million deaths every year, making mosquitoes the deadliest animal in the world. Aedes aegypti mosquitoes are the primary vector of several viral pathogens, including Zika, dengue, and yellow fever viruses, for which treatment options are limited and infection can be deadly. In mosquitoes, biological and physiological processes are modulated by biological clocks including activity patterns, blood feeding, and gene expression. In light of rising insecticide resistance, an improved understanding of mosquito biology is needed to inform novel approaches to address disease transmission. Female mosquitoes are responsible for disease transmission as they depend on blood nutrients and proteins for reproduction. However, the free heme and iron that is released from their blood meals can be extremely toxic, requiring specialized coping mechanisms. In the fruit fly, Drosophila melanogaster, methods of coping with iron toxicity are tightly regulated by circadian clocks. Still, the impact of oxidative stress on the central biological clock and the role of the clock on oxidative stress remains unknown in blood-feeding insects such as mosquitoes. Our research uses interdisciplinary approaches to address this knowledge gap, combining behavioral assays with biochemical and molecular approaches. Towards a better understanding of how components of the clock impact behavioral output, locomotor activity was assessed in mosquitoes with knocked down levels of key clock genes to determine the effect on rhythmic activity patterns. Further, feeding assays using artificial diets with varying iron concentrations were performed to determine how iron impacts the choice to feed as well as ingestion mass and feeding duration. Oxidative stress management was also assessed throughout the day to determine time-dependence. These efforts allow us to discuss the interplay between oxidative stress regulation and the central clock in Ae. aegypti mosquitoes and may be leveraged for informed design of novel insecticides.

Chemo-proteomic Discovery of Putative Lipases in the Asexual Blood Stages of Plasmodium falciparum

Rubayet Elahi, 1:00 PM, GLC Conference Room D

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Keywords: Malaria, Drug discovery, Lipase

Over the last 15 years, Artemisinin-based combination therapies (ACT), along with vector control approaches have contributed to a significant decrease in malaria mortality, however, still an estimated half a million death is reported each year. The recent reports of artemisinin resistance, as well as insecticide resistance, have threatened malaria control and prevention efforts. Development of novel antimalarial drugs, insecticides, and vaccines, as well as improved understanding of parasite biology, are of utmost importance to achieve reduction and/or elimination of malaria. Alike all the other living organisms, Plasmodium falciparum, the deadliest malaria-causing parasite, continuously remodel their lipids using various lipases. Although roles of lipases in various important biological processes including lipid digestion and absorption has been studied in other organisms, in P. falciparum, there are important lipid catabolic processes that have not yet been biochemically defined. Lipase family of enzymes of the serine hydrolase superfamily catalyze the hydrolysis of ester bonds of lipid species such as neutral lipids and phospholipids. Using an activity-based probe (ABP) and lipase-specific inhibitors, we have profiled enzymes of serine hydrolase superfamily with putative lipase activity in the asexual blood stages (ABS) of P. falciparum. Employing affinity purification and mass spectrometric analysis, we have identified 20 serine hydrolases in the ABS of P. falciparum. Among these, 13 have putative lipase activity. We have screened a library of various subclasses of lipase inhibitors in a competitive ABP assay to define lipase specificity. A 42 kDa molecular mass putative lipase of P. falciparum is inhibited by a potent human monoacylglycerol lipase inhibitor. This inhibition profile suggests this enzyme specifically breaks down neutral lipids. In summary, we show here a robust strategy of identifying serine hydrolases with putative lipase activity, which opens the door to discovery of novel biological processes in P. falciparum and possibly present new drug targets.

Implementation and Investigation of a Weather-tuned Network Perimeter Controller

Maha Elouni, Poster Presentation, GLC Multipurpose Room

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Keywords: Network Fundamental Diagram (NFD), Proportional Integral (PI) controller, Weather, Gating

Inclement weather has been shown to increase congestion, justifying the need for weather-responsive traffic control. From one side, all existing weather-responsive controllers currently operate on freeways or limited road segments. From the other side, existing controllers operating on networks do not take into consideration the weather effect on the network fundamental diagram (NFD). The NFD describes the relationship between traffic flow and density (or speed). It is exploited in controlling the traffic flow entering the network in order to minimize congestion and maximize throughput. Applied at the boundaries of the protected sub-network (the zone to be protected from congestion), this control strategy is called perimeter control or gating. This paper describes the development of a macroscopic weather-tuned perimeter controller. First, an NFD-based proportional-integral perimeter controller (PC) is implemented in INTEGRATION, tuned using clear weather data and then tested for clear and inclement weather conditions. In order to respond to weather changes, new sets of control parameters were tuned for each weather (rain and snow) and given to the controller. This weather-tuned perimeter controller (WTPC) is compared to the regular PC. Simulation results show that the WTPC reduces congestion inside the protected sub-network better than PC. Also, it improves the performance of the full network (inside and outside the protected sub-network) in terms of average speed and total delay. Compared to the non-perimeter control case, WTPC increases the average speed of the entire network by 14.22% for rain and 31.26% for snow conditions. Total delay is decreased by 18.86% and 30.53% for rain and snow, respectively.

Augmented Reality Head-up Displays Effect on Drivers' Spatial Knowledge Acquisition and Workload

Nayara Faria, Poster Presentation, GLC Multipurpose Room

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Keywords: Augmented Reality, Heads-up Display, Spatial Knowledge, Human Machine Interfaces

Previous research has demonstrated that providing navigational information using landmark-based Augmented Reality (AR) information on a Heads-up Display (HUD) has the potential to improve driver's wayfinding performance and spatial knowledge. Specifically, Augmented Reality has the potential to enhance landmarks that are not easily communicable and identifiable. However, to the best of our knowledge not much is known about how the perceptual form of Augmented Reality Graphics influence the acquisition of Spatial Knowledge. Specifically, most of the studies are conducted using traditional static 2D graphics, and no research has been reported comparing landmark-based navigation using a true conformal 3D approach. At a high level, the goal of this study is to analyze how to best design the Human Machine Interfaces (HMI) for future vehicles while accounting for the needs, abilities, limitations and preferences of drivers, passengers and other road users. Particularly, this study aims to understand how differing AR perceptual forms -2D screen-relative (i.e., tied to a position on the HUD) or 3D world-relative (i.e., tied to a spatial position in the world) affect driver's behavior and spatial cognition. This study employed a between-subjects design experiment in which twenty-four participants, counterbalanced by gender, drove under one AR HUD condition (either 3D world relative or 2D screen relative perceptual form) through a city using a fixed base, medium fidelity simulator in the COGENT Lab at Virginia Tech. Spatial Knowledge acquisition was measured by Landmark and Route knowledge methods and Workload was subjectively measured using the NASA-TLX questionnaire.

Multidimensional Optimization and Robustness Analysis in the Context of Protein-Ligand Binding

Negin Forouzesh, 10:05 AM, GLC Conference Room C

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Keywords: Protein-Ligand Binding, Free Energy, Multidimensional Optimization, Robustness Analysis

Efficient calculation of protein-ligand binding free energies is highly relevant in many areas, including in drug discovery processes. The corresponding computational methodologies, though, continue to lack in accuracy and efficiency. Implicit solvent models are efficient; however, the accuracy of such models is critically affected by the parameters of the underlying dielectric boundary. Parameters of the boundary, such as atomic radii, are optimized depending on the context. Here, to the best of authors' knowledge for the first time, we perform a global multidimensional search to find optimal atomic radii specifically for protein-ligand binding calculations in implicit solvent. A massively parallel implementation of a deterministic global optimization algorithm (VTDIRECT), and an accurate yet fast generalized Born implicit solvent model (GBNSR6) are employed. A novel general metric inspired by the free energy function is introduced to study the robustness of locally optimal solutions. The optimized atomic radii lead to a more accurate agreement of binding free energy calculations with the reference than those based on two commonly used radii previously optimized for small molecules. The proposed computational approach opens the possibility of improving the accuracy of practical computational protocols for binding free energy calculations.

Consider the Chloroplast: Solanum pennellii Chloroplast Stress Response Highlights Thread of Tomato Clade Evolution

Elisa Gagliano, Poster Presentation, GLC Multipurpose Room

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Keywords: chloroplast, stress, phylogeny, transcriptomics, candidate loci

Expanding studies of evolution to ecologically-relevant systems is important for understanding the basis of speciation. The tomato clade, Solanum sect. Lycopersicon, is a good study system because of the variety of niches the species have adapted to, and the wealth of genetic resources that have been established for the cultivated tomato, S. lycopersicum. Because the cultivated tomato has lost many functions that its wild relatives retain, such as the drought tolerance and herbivore resistance exhibited by S. pennellii., there has been an increased interest in studying the rest of the clade. However, relatively little effort has been made to integrate information from the chloroplast genomes into the scheme of evolution, despite their essential metabolic functions, unique pattern of inheritance, and sheer numbers. In this study, we use Illumina sequencing to gather the chloroplast transcriptional profiles that S. pennellii LA0716 expresses when subjected to drought and a proxy for herbivory, and then reevaluate the tomato clade's chloroplast phylogeny. We performed Bayesian and Maximum Likelihood phylogenetic analyses on the tomato clade chloroplast genomes available on GenBank and a S. pennellii LA2963 chloroplast genome that we assembled from previously available Nanopore data. This yielded phylogenies with key differences from those focusing on nuclear data. The stress tests produced differential expression in 7 of the 113 unique chloroplast genes. Our results indicate that the chloroplast genome could have a significant role in the evolutionary history of the tomato clade.

Investigations into the Life History of the Tennessee Heelsplitter (Lasmigona holstonia)

Alissa Ganser, 3:50 PM, GLC Conference Room D

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Keywords: Freshwater mussel, endangered species, conservation

Freshwater mussels are one of the most imperiled faunas in North America, and current management efforts to support restoration of mussel populations require that key life-history information of a species be determined. Freshwater mussels rely on host fish to complete their life-cycle and to disperse throughout river systems, which can have profound implications on mussel reproductive success. The Tennessee heelsplitter (Lasmigona holstonia) is a headwater-dwelling species with a native range spanning Alabama, Georgia, North Carolina, Tennessee, and Virginia. Currently, L. holstonia is listed as endangered in Virginia, and is a candidate for listing under the U.S. Endangered Species Act. This species is critically understudied, with multiple life-history traits still unknown. In particular, the natural host fishes for L. holstonia remain unconfirmed. For this project, gravid female L. holstonia were collected from three different river systems: Johnson Branch (Clinch River, VA), Crab Orchard Creek (New River, VA), and Cloud Branch (Ocoee River, TN). Mussel larvae (glochidia) were removed from each female and candidate natural host fishes were infested to determine host-fish relationships for L. holstonia. Our results suggest that Banded Sculpin, Black Nose Dace, and Stonerollers are suitable hosts, each offering insight into the dispersal capability of L. holstonia throughout its primary habitat of first and second order streams. Glochidia measurements were taken for each population, and differences in measurements suggest a difference in preference for host fish between mussel populations. Determining host fishes for L. holstonia will provide critical data to develop species distribution models for this mussel, which will assist resource managers in locating previously undocumented populations, determining suitable habitat for reintroduction efforts, and the need for listing this species.

Modeling Instantaneous Cyclist Acceleration and Deceleration Behavior

Ahmed Ghanem, 2:05 PM, GLC Conference Room C

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Keywords: Cycling, Acceleration Behavior, Dynamics-based Model

Cycling has gained more acceptance as a sustainable mode of transportation that can provide an excellent solution for short-distance transfers for several reasons. Typically, cycling involves traveling in less -congested conditions, reduces the traveler's carbon footprint, and improves the traveler's lifestyle. In recent years, bike sharing systems (BSSs) have been introduced in many cities, and there is a growing need to further incorporate bicycles into traffic planning. Many of the widely used microscopic traffic simulation tools have now been extended to model bicycle traffic in addition to vehicular traffic. However, the accuracy and reliability of these frameworks depends mainly on understanding cyclist behavior, but to date there have been few studies in the literature that provide such models. In this paper, we used cycling Global Positioning System (GPS) data collected from 10 people (3 females and 7 males) to develop a dynamics-based cycling acceleration model that captures cyclist aggressiveness. We augmented the model by calibrating the maximum power for average cyclists. We also developed a model that captures cyclist deceleration behavior. The results show that the acceleration model can estimate the cyclist's pedaling input with a root-mean-square error (RMSE) of less than 21% in most cases. The results also show that the deceleration model can estimate cycling deceleration with an RMSE of 12%.

Exploring Risk Co-occurrences in Implementing Smart City Projects in a Developing Nation's Context

Khushboo Gupta, 9:00 AM Flash Talk Round, GLC Conference Room F

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Keywords: Smart cities, Risk co-occurrences, Revealed causal mapping

With an increasing number of smart cities initiatives in developed as well as developing nations, smart cities are seen as a catalyst for improving the quality of life for city residents. However, current understanding of the risks that may hamper successful implementation of smart city projects remain limited due to inadequate data, especially in developing nations. This study aims to identify risks and their interrelationship in implementing smart city projects in India using a mix-method approach. The two sets of data used in this analysis include: risk data available in the smart city proposals for 33 proposed smart cities and interview data from 20 government officials associated in implementing smart city projects in Kakinada and Kanpur. We performed keyword co-occurrence network analysis of risk data followed by revealed causal mapping analysis of interviews to develop model of risk and their interconnections. Our results suggest that risks are not limited to technology and financing, but include challenges related to local governance, social makeup of the city and political leadership in the city. We also found that several risk categories are closely connected. In particular, institutional risks have impacts on other risks. Therefore, risk mitigation strategies need to take a comprehensive view towards all risks and their interconnections instead of managing each risk in isolation.

Soil Respiration and Related Environmental and Remotely Sensed Variables under Different Vegetation Types in a High Elevation Southern Appalachian Forest

Rachel Hammer, Poster Presentation, GLC Multipurpose Room

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Keywords: Soil respiration, Carbon cycling

Forests are very good at capturing carbon dioxide from the atmosphere. The plants and soil in forests also return carbon dioxide back into the atmosphere through the process of respiration. In particular, soil respiration (Rs) is a significant source of carbon dioxide as soil microbes and roots “breathe”. Therefore, even small changes in Rs can have a significant impact on whether a forest is a source or a sink for atmospheric carbon dioxide. Rs is affected by many environmental factors. This study is being conducted in the very biologically complex Appalachian mixed hardwood ecosystem and focuses on how changes in the overstory and understory vegetation influences Rs and whether remotely sensed variables can be used to predict Rs. We are investigating four vegetation types: eastern hemlock (Tsuga canadensis L. Carriere) dominated overstory, mountain laurel (Kalmia latifolia L.) dominated understory, hardwood dominated overstory, and fern dominated understory with four replications each. Remotely sensed variables compiled from the National Ecological Observatory Network (NEON) will be examined for relationships with Rs and environmental variables collected on site. We expect a strong relationship between Rs and soil temperature and moisture. Further we hypothesis that given the very different phenology’s of the vegetation types they will significantly influence the relationships of Rs to the environmental variables. Specifically, we hypothesize that the eastern hemlock dominated overstory, and mountain laurel dominated understory vegetation types will have higher carbon flux rates in the cooler seasons while the hardwood dominated overstory and fern dominated understory will have higher carbon flux in the warmer seasons. If remotely sensed variables relate strongly to Rs, broader scale (e.g. landscape) accurate predictions of Rs will be possible.

Exploring barriers/drivers in Local Business Participation in Downtown Revitalization

Ross Hammes, 9:00 AM Flash Talk Round, GLC Conference Room F

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Keywords: Downtown revitalization, local business participation, small towns

There has been growing concern over the state of small towns in America as they suffer from out-migration and growing lack of social and economic vitality. One approach to addressing these challenges is creating social space and improving quality of life through downtown revitalization. Previous literature have cited leadership of local businesses as a vital ingredient for downtown revitalization. However, only few authors explore the motivation and challenges/drivers to participation by local businesses in smaller cities and towns, in a rural setting. For this research, we ask: (a) Why do local businesses engage in downtown revitalization efforts? and (b) What are the practical barriers and drivers for businesses to engage in downtown revitalization? To answer these questions, we used the case of Christiansburg, Virginia and its downtown revitalization process. This study used a three-step methodology to address this topic. We first identified the local businesses situated in downtown Christiansburg by using GIS tools and surveying the downtown area. Next, we narrowed this list to ten local businesses most frequented by community members and interviewed those businesses to understand their perceived role and existing levels of engagement in downtown revitalization. These interviews were then qualitatively assessed. This study strengthens the findings from the previous literature on the importance of local businesses in downtown revitalization and expands on findings that examine businesses' underlying ontologies that inform their engagement in these activities.

Using Multi-walled Carbon Nano-tubes Filler to Enhance Mechanical Properties of Wholly Thermoplastic Composite Materials for Automotive Applications

Jier Han, 11:50 AM, GLC Conference Room C

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Keywords: novel composites for automotive applications

Wholly thermoplastic composites are the materials of choice for effectively reducing the weight of automobiles and thereby reducing fuel consumption and environmental pollution. They are the materials that are based on matrices reinforced with thermotropic liquid crystalline polymers (TLCPs). One limitation of these composites is their relatively low mechanical properties compared to metal. However, the mechanical properties, Young's modulus and strength, of the wholly thermoplastic composite materials can be increased by adding multi-walled carbon nano-tube (MWCNTs) filler. The product of this technique is called multi-scale composites, which contains two or more types of fillers in order to add reinforcement on two different size scales. Multiscale composites are potentially able to take place of steel or other heavy metals in automotive applications. Previous work in our lab shows that 1% addition of MWCNTs can improve Young's modulus by 50% of a 30wt% carbon fiber (CF)/polyether ether ketone (PEEK). In addition, Vivek et al. (2017) discovers that 5% MWCNTs can increase Young's modulus by 50% and double the strength of Vectra A. Zhang et al. (2004) also shows that 1% addition of MWCNTs could double the Young's modulus and strength of polyamide-6 (PA 6). Based on these interesting improvements, this research focuses on compounding the multi-scale composite, Vectra B/PA 6/MWCNTs, whose properties are competitive with those of CF reinforced thermoplastic composites. Microscope images reveals that MWCNTs interact with Vectra B fibers. Measurement of rheological and tensile tests point that MWCNTs have positive effects on Vectra B fibers. Next step, this research will process Vectra B/PA 6/MWCNTs composites. Theoretically, this novel composite can be strong enough to apply for automotive applications.

A Connected Work Zone Hazard Detection System for Roadway Construction Workers

Wenjun Han, 11:10 AM, GLC Conference Room D

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Keywords: Roadway Work Zone, Safety, Automation, Warning system

Roadway construction workers have to work in close proximity to construction equipment as well as high-speed traffic, exposing them to an elevated risk of collisions which can lead to serious injuries/ fatalities. The standard work zone safety signage and personal protective equipment (PPE) worn by workers at highway work sites have not been completely effective in controlling work zone crashes. In this research, we aim to develop a solution to reduce the risk of collisions at roadway work zones. To this end, an automated hazard detection and prevention system is designed to detect potential threats and improve safety by providing warning of potential collisions. A hazard detection algorithm is developed to identify potential proximity hazards between workers and connected/automated vehicles (CAV) and/or construction equipment. A real-time work zone map is also developed that displays the real-time locations of workers, equipment and CAVs as well as the activities and movement patterns of workers. To assure the accuracy of hazard detection, the algorithm accommodates various parameters including variant safety distance for workers-on-foot, vehicles and equipment, direction of movement, distance from border, type and shape of road, etc. As such, the developed prototype system can be adapted to enhance workers' safety at roadway works zones. The designed system is developed and evaluated through experiments on the Smart Road at Virginia Tech.

“Get Lit”: An Analysis of the Framing of Party-Schools in the U.S.

Lindsey Hanks, Poster Presentation, GLC Multipurpose Room

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Keywords: framing

Universities and college in the U.S. are constantly met with lists such as The Princeton Review’s Top Party School list or similar online rankings that can potentially impact the institutions on a higher scale, as well as local news coverage regarding the institution’s ranking and the drinking and partying habits of its student body. Because few studies have focused exclusively on the various ways of portraying higher education institutions by local news media and how that may impact the relationship between them, this study will be explored through a lens of framing and relationship management theory. Through quantitative content analysis of news frames used in local news coverage of universities or colleges with noted “party-school” reputations in the 2016 to 2017 academic school year, as well as frames represented in the official university responses, this study seeks to uncover how universities that have these noted reputations are framed by the local news media and what classifies an institution as a “party-school.” In addition, the study will explore the ways in which university responses to media coverage impact the potentially mutually-beneficial relationship between higher education institutions, as it is a primary function of public relations. Drawn from previous literature, in order to examine the predominant frames used by local news media in college towns and “party school” university responses, frames of negative emotional appeal, morality, human interest and harm reduction will be explored to determine their salience in written messages found in news headlines and university responses. Upon completion, the results of this study will hopefully provide explanations to a phenomenon that largely impacts the reputation of a higher education institution in the United States, as well as implications for the management of relationships between the media and U.S. universities.

Sensing in 3D Printed Neural Microphysiological Systems

Alexander Haring, 2:45 PM, GLC Conference Room D

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Keywords: Bioprinting, Biosensing, Organ-on-a-chip, Microphysiological Systems

In modern society, major challenges and knowledge gaps remain in our understanding and ability to treat neural diseases, disorders and injuries (NDDIs). One of the barriers to treatment is a lack of understanding of the underlying NDDI pathophysiology which can be difficult to probe in vivo. An additional challenge is low translational success rates between traditional tissue culture and small animal models to human clinical trials. Microphysiological systems show potential to begin bridging this gap in fundamental understanding and improve translational results. Microphysiological systems are miniaturized "organs-on-chips" which are comprised of 2D or 3D cell cultures with integrated functionality such as biochemical or mechanical cues to mimic physiological conditions. My research focuses on implementing the novel manufacturing capabilities of 3D bioprinting to fabricate microphysiological systems for NDDIs ranging from glioblastoma, an aggressive brain tumor, to peripheral nerve injury, one of the most prevalent NDDIs. Not only does 3D printing allow for rapid manufacturing and complex geometrical design, but the relatively low stress and moderate temperature process also allows for direct manufacturing of biological and cell-laden materials. Towards this, we recently developed a bioprinting ink based on gelatin and hyaluronic acid which exhibited mechanical and biochemical properties mimicking neural tissue extracellular matrix in addition to excellent rheological properties for high fidelity 3D printing of cell-laden neuronal and glial tissues. An additional goal of my research is to incorporate biosensors into microphysiological systems. Biosensors provide real-time data such as quantification of target biomolecules or changes in 3D culture mechanical properties. This synergy of the fields of advanced manufacturing, biomimetic hydrogels, and biosensors holds promise for improving fundamental knowledge of NDDI pathology as well as enhanced preclinical screening results.

Developing High Bridge Trail State Park Conceptual Plan: a New Perspective on Interdisciplinary Learning and Collaboration

Sara Harrell, 1:00 PM, GLC Conference Room C

Authors: Sara Harrell, Stephanie Lovely, Keri Friedman, Hollis Hatfield, Madison Hutchings, Liangyu Shen, and Briggs Wakeman

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Keywords: interdisciplinary, design, landscape architecture, state park

This project comes out of a collaborative interdisciplinary studio in the Landscape Architecture Program. High Bridge Trail is a 31.1-mile multi-use trail between Pamplin City and Burkeville, VA. Its namesake and crown jewel, the historic ½ mile long High Bridge, opened in 2012 as a pedestrian-friendly connection. Now a regional attraction, the bridge draws thousands of visitors annually who come to see the engineering marvel and take in views of the forest canopy at 116 feet above the Appomattox River. The purpose of this project was to develop a suite of design ideas and concepts that would build on existing infrastructure and programming, all with the purpose of enhancing user experience both along the trail and at High Bridge specifically. This presentation illustrates how 7 undergraduate and graduate students from diverse educational backgrounds came together to develop a conceptual plan for the park. The students hailed from Wildlife Conservation, Landscape Architecture, Architecture, Urban Forestry, Architecture & Design Research and Agriculture, Leadership and Community Education majors. Within the group three are pursuing minors in Animal & Poultry Science, Leadership & Social Change and Landscape Architecture. Professor Patrick Miller, Ph.D., guided the studio and encouraged each of us to pursue projects that appealed to our individual interests. As both a student in the course and team leader for the project, I helped facilitate the studio and worked individually with my teammates to help them develop their design ideas and in the end, was a major contributor to the project's final documentation. This presentation shares my experience in peer-to-peer teaching and learning and how the design studio's atmosphere and philosophy can be leveraged to both broaden the experience of design and non-design majors and demonstrate how collaboration is key to design development and gaining new perspectives in teaching, learning, research and service.

Determining Dosimetry Metrics for Histotripsy Liver Cancer Ablation: Comparative Study of Histotripsy in Excised Tumor, Liver, and Local Critical Structures

Alissa Hendricks, 10:45 AM, GLC Conference Room D

Authors: Alissa Hendricks, Alex Simon, Alyssa Gentry, Peter Weber, Vincent Wang, David Luyimbazi, Sheryl Coutermarsh-Ott, Irving C Allen, Eli Vlaisavljevich

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Keywords: Histotripsy, ablation, liver, cancer

Cancer is the second-leading cause of death world-wide, with the incidence of liver cancer growing significantly over the last decade. Addressing this, we are developing Histotripsy, an image-guided, non-thermal, non-invasive focused ultrasound therapy that ablates tissue with millimeter precision. By focusing high-pressure ultrasound pulses, cavitation bubbles form and collapse inside targeted-tissues, resulting in complete target disintegration. Due to this mechanical-mechanism, studies have shown that strong tissues are more resilient to Histotripsy and require a higher dose (i.e. number of pulses) to be fully ablated. Preliminary studies suggest that Histotripsy can safely and effectively ablate liver, and tumor, tissue near critical structures, such as vessels and bile ducts, while preserving these structures. For this study, we utilized an ex vivo model to test histotripsy parameters on porcine liver tissues and surrounding critical structures: gallbladder, vessels, intestines, stomach. Additionally, we conducted dosage tests on human liver tumors and tissues. Tissue mechanical properties were measured with ultrasound elastography, and damage was assessed using gross morphology and histopathology. Results showed that tissues with higher shear moduli require higher dosages to reach ablation, matching our hypothesis. For example, we found liver (shear-modulus 18kPa) to ablate with 250pulses, while stomach (55kPa) gets mildly damaged at 2,000pulses. Although tissues such as stomach and intestines have layers that appear to have weaker properties than areas of interest, more muscular and connective layers appeared to offer protection from clinically relevant damage. Even though a primary liver tumor is weak (14kPa) and should easily ablate, metastatic-colonic tumors in liver are stiffer (24kPa) and require a higher dose. Overall, these results indicate that Histotripsy parameters can be tailored for ablating tumors in liver without inducing relevant damage to critical structures. These results provide a rational basis for tailoring treatment of liver tumors in high-risk locations near critical structures.

Influence of Host Genetics on the Epithelial-associated Microbiomes in Aquaculture-raised Nile Tilapia (Oreochromis niloticus)

Ian Hines, 3:10 PM, GLC Conference Room C

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Keywords: Microbiome, Next-generation sequencing, QIIME, Aquaculture, Genotype

Aquaculture provides a sustainable alternative to wild-caught fisheries. An animal's microbiome is vital to its nutrition, growth, and overall health. Exogenous factors such as diet and the rearing environment are known to affect the microbiome. However, little is known about the role that host genetics plays on the microbiome structure. To investigate the potential influence of host genetics on the community of microorganisms present in the host, skin and intestinal epithelial tissues were harvested from three proprietary family lines of Nile tilapia (Oreochromis niloticus) that differ by one genetic trait. Prior work demonstrated that one of the genetically-related lines has a much higher growth rate than the other two, when age and environmental conditions are controlled. It was hypothesized that the animal's microbiome was a contributing factor to the observed differences in growth. Therefore, the V4 region of the bacterial 16S rRNA gene was amplified using DNA separately extracted from the scales or midgut portions of the intestines. The resulting PCR products were gel purified and sequenced via Illumina MiSeq protocols. Preliminary QIIME bioinformatics analysis of the intestinal samples has revealed noticeable differences in the microbiome structure between the faster growing fish and the other family lines. The most abundant bacterial families in the more productive fish line, Mycoplasmataceae and Fusobacteriaceae, are virtually absent in the other two lines, which have higher levels of Enterobacteriaceae. Analysis of skin samples is on-going. Thus, fish lines differentiated only by the alteration of a single trait exhibited differences in the host-associated microbial communities.

Understanding the Interactions between Development and Nest Depredation in Bog Turtles

Michael Holden, Poster Presentation, GLC Multipurpose Room

Authors: Michael T. Holden, Virginia Tech, Michaelholden@vt.edu. Joseph C. Barron II, Jeffery R. Feaga, Emmanuel A. Frimpong, Carola A. Haas, Virginia Tech.*

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Keywords: Wetland, bog turtle, nest predation

Animals such as raccoons, skunks, and opossums are documented to depredate a wide variety of terrestrial nests. These mesocarnivores are also known to persist in artificially inflated densities in relation to human activity, subsidized by anthropogenic food sources and refuse material. While studies show that these animals both depredate terrestrial nests, and persist at augmented population densities along an urban gradient, there is a lack of understanding on how these factors interact. While numerous species face these depredation pressures, I plan to conduct this research within the context of bog turtle (Glyptemys muhlenbergii) conservation. This species is a prime candidate for this research for a number of reasons. G. muhlenbergii is declining across much of its range, requiring a thorough understanding of the primary drivers of decline for this species. Additionally, they lay terrestrial nests, with documented depredation by mesocarnivores. These nests are easily replicated, as they are non-randomly placed, small in clutch size, and shallowly lain. To investigate these interactions, I plan to construct artificial nests in conjunction with camera traps during the 2019 field season. These nests will be placed at varying distances to human developments such as residential structures and roads. Furthermore, by mid-February I plan to conduct a GIS analysis assessing the potential anthropogenic impact on G. muhlenbergii wetlands. I will use available spatial data and a previously developed GIS-based habitat model to identify what proportion of wetlands predicted to be suitable for bog turtles in southwest Virginia occur in close proximity to established human infrastructure.

3D Simulator for ICON MIGHTI Data-Model comparison

Md Nurul Huda, 3:50 PM, GLC Conference Room C

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Keywords: Space Weather, Ionospheric Data, MIGHTI Instrument

The connection between earth and space weather has numerous impacts on spacecraft, radio communications and GPS signals. Thus, predicted & modeling this region is important, yet models (both empirical and first-principles) do a poor job of characterizing the variability of this region. One of the main objectives of the ICON mission is to measure the variability of the ionosphere and thermosphere at low-mid latitudes. This is primarily done with a suite of four instruments, three remote-sensing and one in situ MIGHTI, IVM, FUV, EUV. The MIGHTI instrument measures the horizontal wind speed and direction with 2 discrete MIGHTI units, separated by 90˚, mounted on the ICON Payload Interface Plate. The work focuses on building a simulation of the MIGHTI data, using a first-principles model as the input dataset, which will be used for early validation and comparison to the MIGHTI data. Using a ray-tracing approach, parameters like O, O2, O+, O2+, T, wind, F10.7 will be read for every point along every ray from the model and brightness and Line of Sight (LOS) wind will be calculated as functions of altitude and time. These data will be compared to the MIGHTI observations to both to establish the limitation of such models, and to validate the ICON data. ICON will help determine the physics of our space environment and pave the way for mitigating its effects on our technology, communications systems and society.

Reduction in Required Reagents and Sludge Generation in Fenton's Oxidation of Landfill Leachate through Forward Osmosis and Humic Acid Recovery

Syeed Md Iskander, 11:10 AM, GLC Conference Room C

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Keywords: Landfill leachate, Fenton's oxidation, Forward osmosis, Resource recovery

About half of the municipal solid waste in the US ends up in landfills. In a landfill, the combination of precipitation and waste degradation produce leachate, a complex wastewater. At present, leachate is mostly treated biologically, without any resource recovery. However, recalcitrant leachate organics can escape biological treatment and contaminate natural water bodies. Thus, other treatment approaches are receiving attention. Among them, Fenton's oxidation is the most effective for leachate treatment. Fenton's oxidation is the reaction of ferrous salt and hydrogen peroxide that produces hydroxyl radical, a strong oxidizing agent, which can effectively degrade leachate organics. But high reagent requirements and sludge generation limit the application of Fenton's oxidation in landfill leachate treatment. To address these limitations, forward osmosis (FO) and humic acid (HA) recovery were used in addition to Fenton's oxidation. Forward osmosis, a fouling resilient membrane separation technology, was applied to recover water while concentrating leachate and humic acid was recovered as an organic fertilizer. In FO treatment, leachate was concentrated 3.2 times in 10 hours. The recovered HA increased from 1.86 to 2.45 g L-1 at pH 2 after FO concentration. During the FO operation, the concentration gradient drove alkalinity causing species (i.e., HCO3-, CO32-) to the draw side of the membrane. Accordingly, the H2SO4 requirement decreased by 25.2% after FO treatment. The HA recovery also decreased sludge generation by 29.1%. Additionally, the proposed system reduced the required NaOH by 34.6%, and both FeSO4.7H2O and H2O2 by 35.1%, compared to the Fenton's treatment of raw leachate alone. These results show that the proposed system can decrease leachate volume, lower reagent requirements, reduce sludge production in Fenton's oxidation of leachate, and recover HA as a resource. The broader impacts of this study include improvements in sustainability and cost efficiency of leachate treatment that can benefit the society.

Aligning Decision Tools with Cultural Values Through Goal Framing

Dalya Ismael, Poster Presentation, GLC Multipurpose Room

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Keywords: Culture, goal framing, rating systems, sustainability

Culture is an essential aspect of sustainability and is considered a significant part of the environmental, financial and social dimensions of sustainable development. However, many engineering decision tools like sustainability rating systems that are used to guide the design process are not tailored to account for cultural differences among engineers globally. Cultural differences such as social norms, environmental attitudes, or regional variations such as climate conditions and policies must also be considered in the design and presentation of the information to engineers using these rating systems. Applying behavioral interventions such as goal framing can help align rating systems to user preferences, project goals, and cultures. Goal framing structures the information to focus on the outcome of the decision or action. We compared how the choices of engineering professionals in different countries (the U.S. and Kuwait) when credits of the Envision rating system are goal framed to emphasize the social, environmental, or financial outcomes of completing each credit. The results show that goal framing increased engineering professionals' motivation to achieve sustainability credits among all participants. The effect was greater among professionals in Kuwait compared to the U.S. by 22 percent. Kuwait professionals highly valued credits goal framed to emphasize societal benefits, whereas U.S. professionals placed more value on credits goal framed to emphasize positive financial outcomes. Surprisingly, environmental attitudes had no effect on whether the goal framing intervention influenced design choice. These findings highlight the differences of behavioral interventions across cultures which can be directly applied to sustainability rating tools.

Improvements to the Global Oceanic Model

Arman Izadi, 9:00 AM Flash Talk Round, GLC Conference Room F

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Keywords: Air Transportation Systems, Simulation, Optimization

This talk demonstrates some of the recent improvements to the Global Oceanic (GO) model. The GO model is a computer simulation model developed jointly by the Virginia Tech Air Transportation Systems Laboratory (ATSL) and the Federal Aviation Administration (FAA). This model offers a quick, inexpensive and realistic evaluation on the new policies, procedures, and technologies proposed to improve flight operations over global oceanic airspace. The adoption of reduced oceanic separation standards using technologies such as Space-Based ADS-B (Automatic Dependent Surveillance-Broadcast) promises to save fuel consumption, reduce emissions and cut costs for aircraft operators. Decision makers such as the FAA need computer simulation tools to evaluate the benefits and costs of future concepts of operations regarding fuel consumption, travel time, air traffic controllers' workload and safety.

The GO model employs a discrete-time, numerical integration algorithm to simulate all phases of the flight from takeoff to landing. The model uses the Euro-Control BADA 3.13 aircraft model specification with enhanced performance specifications for 192 commercial aircraft. We developed the model with a variable Mach number optimization routine derived from the BADA 4.0 performance model. This functionality consists of the optimized cost tables enabling the model to find and assign the optimal Mach number to a given aircraft type for a variety of aircraft mass, altitude and wind speeds. To address the task of simulating diverse regions with distinct separation standards, the GO model was modified to include multi-region simulation capabilities with multiple separation standards and various aircraft equipage levels. Another feature of the GO model is a flight plan optimization tool for generating wind-optimal flight trajectories worldwide using the wind and air temperature models. The FAA has relied on the results obtained with the GO model in multiple airspace (North Atlantic, Pacific, and the Caribbean) to provide inputs to their working groups.

A Framework for Utilization of CFD in the Early Stages of Architectural Design

Soo Jeong Jo, 3:00 PM Flash Talk Round, GLC Conference Room F

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Keywords: architecture, design, CFD, application, early stage

Computational Fluid Dynamics (CFD) is a numerical methodology for simulating the movement of fluid. Due to its efficiency, CFD has been widely used in aerospace engineering since the 1970s. It also has a great potential in the architectural field since airflow has been an important player in architectural design. However, the complexity of CFD has been a barrier, and thus, the CFD users in the building industry tend to be limited to researchers or engineers rather than architectural designers in general. As a result, CFD has been used for evaluating a completed design rather than participating in the design process. However, the benefit of using CFD would be maximized through its early application since key design decisions are made in the early stages of design. In response to this, CFD platforms specialized for the early stages of design are developed recently, which offer user-friendly interfaces.

Within this context, this study aims to introduce and evaluate the new CFD platforms providing a framework for utilizing them as one of the early-design tools. Under this objective, three questions are raised about the following topics: appropriate platforms for each phase of architectural design, necessary knowledge set to effectively use CFD as a designer, and the application of CFD in the architectural design process. To answer these questions, a mixed-method approach is employed that includes quantitative and qualitative assessments of the software and immersive case studies for structuring the design framework. These studies will examine the potential of CFD as an early-design tool expecting the following outcomes: recommendations on appropriate platforms for different design phases, exemplary projects, references for teaching CFD in architectural design programs. The utilization of CFD will provide a prompt and convincing analysis in the early stages of architectural design, which entails a more integrative design process and a better-quality environment.

Assessing Mathematical Cognition Behaviorally and Neurologically: Working Memory and Units Coordination Theoretical Framework

Sarah Kerrigan, 3:30 PM, GLC Conference Room C

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Keywords: Mathematics Education, Working Memory, Cognition

Understanding student cognition has been a crucial part of mathematics educational research for decades. Knowledge of students' struggles and cognitive development in mathematics is important in developing better curricula that foster mathematical foundations. It has been show that the construct of units coordination is central in students' mathematical development (Steffe, 1992; Ulrich, 2015), as has the psychological construct of working memory (Blankenship, Keith, Calkins & Bell, 2018;Bull & Lee, 2014). Our research team is building a theory that incorporates units coordination and working memory in order to better describe students mathematics behaviorally as well as neurologically. The theory offers a new psychological and neurological perspective on why higher-level cognitive structures allow for more advanced mathematics, a common theme throughout the literature (Hackenberg & Lee, 2015; Hackenberg & Tillema, 2009). Working with students found in the literature has demonstrated how our framework captures nuances in students' mathematics and helps explain where and why students struggle with particular types of tasks. We are currently conducting a small pilot study to test this framework in its utility in predicting student outcomes on fraction tasks. With this study, we hope to refine our framework and elucidate its use as a tool for researchers and teachers in selecting appropriately cognitively demanding tasks for students as well as test the neurological hypotheses this framework incorporates with the working memory component. Our broader goal beyond this pilot study is to investigate the theory's ability to predict students' mathematical cognition with a range of ages and across mathematical domains (number construction, fractions, algebra, functions). Overall this talk discusses a theoretical framework build from math education, psychology, and neuroscience aims to increase understanding of how students cognitively constructing mathematical content knowledge in order to design better informed curriculum.

Development of a conceptual framework and assessment tools to assess the Foot and Mouth Disease (FMD) control program in the proposed FMD-free zone in Thailand

Naree Ketusing, Poster Presentation, GLC Multipurpose Room

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Keywords: Foot and Mouth Disease; disease control; FMD-free zone; assessment; Thailand

Objective(s): This study proposes a conceptual framework and assessment tools for use in the evaluation of the current FMD control policy in Thailand and its implementation in the proposed FMD-free zone.
Materials and methods: To develop the framework and assessment tools, data were collected to identify: (i) a list of essential elements of a successful FMD control program; (ii) a stakeholders list; and (iii) a list of relevant regulations and other documents. The framework and assessment tool were developed with the conditions that: (i) testing and diagnostic systems were adequate, rapid, and satisfied international standards, and (ii) the reporting system had an appropriate design.
Results: The proposed framework includes essential characteristics of policy design and implementation that should be found in the FMD control program in Thailand. The assessment tools included an assessment matrix and three sets of questionnaires. The assessment matrix identified shortcomings of policy design, policy implementation, veterinary capacity, and stakeholder engagement. The questionnaires were designed to collect supporting information to verify if elements of the FMD control program were consistent with criteria in the assessment matrix.

Conclusions: No framework or tools currently are available to assess the FMD control system in Thailand. The tools described here have been developed to determine whether the design and implementation of the current FMD control program in the proposed FMD-free zone in Thailand follows international requirements for establishing an FMD-free zone with vaccination.

Fabrication of Plasmonic Nanoparticle-Polymer Composite Thin-Films for Application in Tinted Glass

Assad Ullah Khan, 1:20 PM, GLC Conference Room B

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Keywords: Nanoparticles, Polymers, Tinted Glass

About 1600 years ago, without any knowledge of plasmonics, the Romans randomly mixed plasmonic nanoparticles in ceramics and made the first plasmonic nanocomposite—the Lycurgus cup that changed its color between red and green depending on the incident light direction. Today, based on advanced plasmonic nanoparticle science, we take lessons from this ancient technology to design modern tinted glass. We demonstrate the first set of “spectral-selective plasmonic nanocomposites”, which are comprised of polymers and planarly oriented silver nanoparticles of judiciously selected sizes and compositions. Instead of simply switching colors between red and green, the new plasmonic polymer nanocomposites spectral-selectively reflect, scatter, and filter light of any desired wavelength, which will impact enormously on the tinted glass in modern energy-efficient buildings.

Therapeutic Focused Ultrasound Stimulated Controlled Release of Nitric Oxide from an Injectable Hydrogel

Zerin Mahzabin Khan, 10:05 AM, GLC Conference Room D

Authors: Zerin Mahzabin Khan, Kaylee Meyers, Scott Verbridge, Rupak Rajachar, Eli Vlaisavljevich

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Keywords: Injectable Hydrogel, Focused Ultrasound, Nitric Oxide, Controlled Release

Nitric oxide (NO) is an essential agent for wound healing and tissue repair. It is important to modulate NO levels, as too low/high concentrations lead to adverse consequences like decrease in tissue stability and cell death. To address this need, our team developed a novel injectable hydrogel with embedded fibrin microparticles that release NO when exposed to light or heat. However, although previous work has shown controlled NO release using these methods, clinical application is limited due to low penetration depth (light) and potential damage to surrounding tissue (heat). This study addresses these issues by leveraging focused ultrasound (FUS) for non-invasive NO release. FUS uses acoustic lenses to concentrate ultrasound energy beams to a target at a focal point. We hypothesize that FUS applied by an external transducer can be used to induce local mechanical or thermal effects that stimulate release of NO from our injectable hydrogels with high spatiotemporal precision. To test this hypothesis, 3D printed gel molds were designed to conduct in vitro NO release studies. Synthesized hydrogels were subjected to either FUS (700 kHz pulses, 5 MPa negative pressure, 500 Hz repetition rate) or ultraviolet (UV) light, respectively. A chemical assay detecting the presence of nitrites based on their absorbance at 548 nm in a spectrophotometer was used to quantify NO release. Results revealed NO release from hydrogels due to FUS was comparable to release due to direct UV light exposure, with an 18% higher release from FUS observed compared to negative controls, indicating FUS may be utilized as a non-invasive and high resolution release mechanism for in vivo applications. Results also revealed the nitrite chemical assay was not appropriate for quantifying gaseous NO release, and therefore an alternate NO quantification method would need to be implemented in future studies to gain more conclusive and quantitative results.

Relationship Management in Public Private Partnership Projects: Literature Synthesis and a Path Forward

Mayank Khurana, Poster Presentation, GLC Multipurpose Room

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Keywords: Public Private Partnerships, Relationship Management, Literature Review, Success Factors

A public-private partnership (PPP) project generally spans across a period of 30 years or more and is exposed to uncertainties. The possibility of a PPP project contract to cover all the events affecting different stakeholders in the future, particularly the public agency and the concessionaire, is low. Therefore, a need to effectively manage relationships has been identified in the literature to complement contractual arrangements. Relationship Management (RM) is a relatively new approach which aims at changing the perception of an organization towards maintaining relationships. RM is a more proactive approach towards developing coordination and trust within teams to achieve desired project outcomes. The aim of this paper is to review studies pertaining to RM in PPP projects through 2018 to identify research trends as well as suggest areas for future investigation. Studies examining relational contracting in construction projects were also reviewed given their relevance to the subject. Four major themes have been identified through literature review: papers emphasizing the need for relationship management, papers addressing the argument concerning contractual and relational governance being complementary or substitutable, papers identifying the critical factors that enable or inhibit strong relationships and papers proposing a qualitative or a quantitative framework to measure relationship strength. The four themes identified are shown connected to each other as they have been arranged in a three staged linear structure. The findings also suggest that the factors affecting relationship management can be organized into three major categories: intra-organizational, inter-organizational and other factors. Based on the suggested linear structure of the themes, four directions of future research have also been proposed in the paper.

Discovery of New Regulatory Small RNAs in Brucella abortus

Kellie King, 2:00 PM Flash Talk Round, GLC Conference Room F

Authors: Kellie King 1, James Budnick 1, Kirsten Kohl 1, Kevin Lahmers 1, Pawel Michalak 2 and Clayton Caswell 1

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Keywords: Bacteria, regulation, stress response

Small RNAs (sRNAs) are a class of regulatory molecules that impact gene expression in bacteria. These sRNA are often located in intergenic regions, and they have been shown to play crucial roles in the virulence in bacteria, including Brucella abortus. This bacterium causes brucellosis, which is a zoonotic infection of cattle, bison, and elk, but can also be transferred to humans by coming in-contact with infected animals and animal products. B. abortus is an intracellular pathogen that resides in macrophages during infection. This is a specialized niche where B. abortus encounters various stressful conditions that influence gene expression during trafficking through the macrophage. In this study, B. abortus was stressed in various conditions that could be encountered in the macrophage, including low pH, oxidative stress, and nutrient limitation. Transcriptomic data reveals high levels of transcripts located in intergenic regions, which is characteristic of sRNAs. Northern blot analyses confirmed the presence of nine new sRNAs. Genetic manipulation is being employed to delete these sRNA from the genome, and further phenotypic assays and infection models will be used to determine the contribution of these new sRNA to the biology and virulence of B. abortus.

Equity in Children's Audiobooks: Investigating the Whiteness of Six U.S. Library Systems' Offerings

Rachelle Kuehl, Poster Presentation, GLC Multipurpose Room

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Keywords: audiobooks, equity, literature, race, ethnicity

Critical Race Theory provides a means for scholars to examine and bring awareness to persistent racism in society (Taylor, 2009). Among its key principles is Whiteness as Property (Harris, 1993), a concept based on relations of power wherein White people benefit from—but often don't recognize—countless unearned advantages such as the ability to enter a public library and access limitless material reflecting the experiences of White people.

Because many children have impaired sight or difficulty reading, audiobooks represent an important point of access to children's literature, especially novels (Clark, 2007). Accordingly, there must be equitable access to a broad range of high-quality children's novels via audiobooks.

No published research exists concerning equity of access to audiobooks reflecting the experiences of people of color. Thus, this study will fill a gap by helping book publishers and librarians understand whether they may be denying meaningful listening opportunities to the public.

This poster reports an investigation into the equity of access to high-quality children's literature via audiobooks across six public library systems in widespread U.S. cities. The online catalogs of each system were consulted to determine the availability of 195 award-winning children's novels in various formats. A comparison across the systems revealed a disproportionately high availability of audiobooks featuring White characters in primary roles. Alerting educators to this inequity is necessary to ensure stories featuring characters of color find their way into students' headphones.

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Spatial Distribution and Temporal Change of a Ruminant-Specific Microbial Marker and Antibiotics in Manure-Amended Soils via Surface Application and Subsurface Injection

Hanh Le, 10:00 AM Flash Talk Round, GLC Conference Room F

Authors: Hanh Thi Van Le, Chaoqi Chen, Rory Maguire, and Kang Xia

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Keywords: Antibiotics, antibiotic resistance, manure bimarker, waste management, subsurface injection

Compared with surface application (traditional method to broadcast manure on soil surface), subsurface injection (new method to inject manure below soil surface) is promising to reduce nutrients and manure-borne antibiotics in surface runoff to the surrounding environment. The concern is that the subsurface injection creates injection slits (where manure is injected) with elevated levels of nutrients, organic matter, water, and antibiotics, which might be “hot zone” to encourage growth of antibiotic resistant microorganisms. A field study was conducted to 1) monitor spatial distribution and temporal change of rum2bac (a ruminant biomarker) and 2) examine its correlation with antibiotics in soils following manure surface application and subsurface injection. Dairy manure containing antibiotics was applied, followed by a simulated rainfall. Soil samples were collected from 0-5 and 5-20 cm immediately before and after rainfall, and 3, 8, and 17 d after manure application. Soil samples were collected inside injection slits, 5, and 25 cm from the injection slits. Rum2bac and antibiotics in the soil samples were quantified using real-time polymerase chain reaction and liquid chromatography tandem mass spectrometry, respectively. Results showed that rum2bac mainly concentrated inside the slits and within 5 cm from slits following manure subsurface injection and after a subsequent rainfall. Rum2bac abundance in the slits and within 5 cm was at least one order of magnitude higher than at 25 cm from the slits. In addition, rum2bac abundance in the slits was higher than that in the surface application treatment. Comparing to the day of manure application, levels of Rum2bac and antibiotics in soils reduced by >90% and >80%, respectively, 17 days later. Their levels were positively correlated, suggesting co-distribution and co-change of antibiotics and manure microorganisms/genes after manure application. Therefore, antibiotics can exert selection pressure on manure microbes leading to possibility of enhanced development of antibiotic resistance.

Comparative Transcriptome Analysis Reveals Conserved Genomic Characteristics of Drought Responsive Genes Across Multiple Plant Species

Jiyoung Lee, Poster Presentation, GLC Multipurpose Room

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Keywords: Drought stress, Comparative transcriptome analysis, crop species, conserved drought responses

Drought stress is one of the most important abiotic stresses, and can negatively impacts agricultural production through slowing plant growth and reducing crop yield. This study explores what genomic characteristics are conserved for drought responses across five plant species including Arabidopsis, soybean, poplar, rice and maize. Because most gene functions in plants have been identified in the model species, Arabidopsis thaliana, comparative transcriptome analysis between Arabidopsis and other plant species is particularly important for functional annotation of genes in other plant species. We have developed a unified computational pipeline to investigate conserved drought responsive genes and regulatory sequences across these five species. Using this pipeline, we analyzed differentially expressed genes from published RNA-seq data related to drought stress, and identified 120 common gene families induced by drought in these plant species. Using Gene Ontology (GO) enrichment analysis, we identified five GO functional categories enriched with drought responsive genes. Using a protein phosphatase 2C (PP2C) gene family as one example, we compared regulatory sequences and transcription factor binding motifs of drought-induced genes in this gene family. We detected four types of motifs conserved in this gene family across these five species. Taken together, the results of this study reveal hundreds of common gene families with conserved drought responses, and conserved regulatory motifs across multiple species. The discoveries and computational pipeline developed in this study could be useful to annotate gene functions and understand underlying mechanisms of gene regulation in crop species under other abiotic and biotic stress conditions.

Enclosable Futures: The Commons, Prison-Time, and Political Economy

Jack Leff, 1:20 PM, GLC Conference Room C

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Keywords: Prison abolition, Political Theory, Economics

One of Marx's most startling predictions from the later volumes of Capital was that capitalism's downfall was inevitable due to internal contradictions in its structure that would cause it to collapse in on itself. While capitalism has undoubtedly existed in a state of continual crisis, its undoing has proven itself to be anything but inevitable. Far outlasting even Marx's most conservative predictions, capitalism has proven itself to be far less rigid than expected and has developed ways to ameliorate its contradictions, often at the expense of capitalism's citizens. This paper seeks to identify one such way in which capitalism continues to facilitate its existence. Specifically, I argue that the prison industrial complex in the United States functions as a technology by which the prisoners' very futures are fashioned into the new commons for "public" (scare-quotes intentional) consumption. Much like the enclosure movement in England or the enclosing on the bodies of women in Sylvia Federici's work, the goal of prisons is to protect capitalism from itself by maintaining a set of resources available to the elite.

Building off the work of Ruth Wilson Gilmore, Angela Davis, and other prison abolitionists, I argue that prisons function as a temporal political technology in two ways. The first is that prisons enclose upon prisoner's bodies in the present through mass incarceration's various means of confinement. The second is that this enclosure of bodies in the present is used to justify the move to make prisoner's futures available for selective "public" consumption. The enclosure of prisoners' very futures serves to protect capitalism in a variety of ways. I conclude my paper by lifting up important prison abolitionist work that is being led by incarcerated people themselves, as they provide the most powerful insights on how to break down the prison industrial complex.

The Effects of Relative Humidity on the Viability of Infectious Agents and Transmission of Infectious Diseases

Kaisen Lin, 10:25 AM, GLC Conference Room C

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Keywords: Infectious disease, relative humidity, viability, transmission

Infectious diseases, such as lower respiratory infections and tuberculosis, are among the leading causes of death globally. Successful transmission of infectious disease requires infectious agents to remain viable during their transport from infected individuals to susceptible individuals. Thus, understanding the viability of infectious agents in the environment is critical in control of infectious disease transmission. Previous studies have demonstrated that relative humidity (RH) can affect the viability of infectious agents, including bacteria and viruses. However, conflicting results have been reported. In this study, we investigated the influence of RH on the viability of gram-negative and gram-positive bacteria (E. coli and M. smegmatis) and unenveloped and enveloped viruses (MS2 and Phi-6) at RHs ranging from 20% to 100% in suspended aerosols and stationary droplets. Bacterial viability was higher under more humid conditions and decreased monotonically with RH in general. Virus viability demonstrated a U-shaped pattern with the lowest viability at 55% and 75% RH for MS2 and Phi-6, respectively, and higher viability at RHs lower than 40% and higher than 85%. Evaporation, which is controlled by RH, affects both the physics and chemistry of aerosols and droplets, in turn affecting the viability and transmissibility of bacteria and viruses. A more rapid decease in droplet size was observed at lower RH than that at higher RH due to faster water evaporation, so lower RH allows infectious agents remain airborne longer. For infectious diseases whose transmission is dominated by aerosols and droplets, humidity indirectly affects the potential for pathogens to infect susceptible individuals.

The Impacts of Climate Change on Rice Production and Small Farmers' Adaptation: A Case of Guyana

Omchand Mahdu, 1:20 PM, GLC Conference Room D

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Keywords: climate change, climate variability, rice production, small farmers, climate adaptation, Guyana

The vast majority of climate change impacts on rice production result from fluctuations in precipitation and temperature that lead to flooding, water scarcity, and increases in insects and pests, diseases, and weeds. Guyana is highly vulnerable to climate change. More importantly, the country relies heavily on rice cultivation for food, employment, and export earnings. Of particular importance are the impacts of climate change on small farmers (cultivating less than 4.45 hectares) and their ability to successfully adapt. Small farmers are especially vulnerable because they often lack the necessary knowledge, support, and resources to effectively respond and adapt. Given the large percentage of rice farmers engaged in small-scale production in Guyana, this study investigated the impacts of climate variability on rice production and the extent to which the production and productivity of small farmers are affected.

Analysis of farm-level data showed that changes in rainfall included an increase in intensity and out of season rain which affected harvesting due to poor farm-to-market roads, wet fields, and lodging of plants. The main responses involved adjusting planting dates based on water availability and the cultivation different rice varieties. Changes in temperature resulted in hotter days which accelerated the evaporation of water from the field. In response, farmers replenish their fields assuming water was available. Extreme weather events such as excess rainfall and associated flooding submerged, uprooted, and/or killed young plants while drought stunted the growth of plants. Farmers pumped in and out water from their fields in response to drought and flooding, respectively. An increase in paddy bug infestations damaged the grains resulting in lower quality while an increase in red rice and duckweed increased competition for space, sunlight, nutrients, and water. Farmers engaged in more preventative spraying and used a contact chemical to burn red rice.

Secondary Cell Wall Associated Transcription Factors Popnac154 and Popnac156 Regulate Leaf Senescence and Growth Responses to Nutrient Availability

Ayeshan Mahendra, Poster Presentation, GLC Multipurpose Room

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Keywords: transcription factors, amiRNA transgenics, nutrient deprivation

The transcription factor SECONDARY WALL-ASSOCIATED NAC DOMAIN2 (SND2) promotes secondary cell wall (SCW) thickening in Arabidopsis (Zhong, Lee et al. 2008, Wang, Tang et al. 2013). The Populus genome contains two putative co-orthologs of SND2, NAC154 and NAC156, which are predominately expressed in developing xylem and phloem fibers (Grant, Fujino et al. 2010). In contrast to Arabidopsis, overexpression of NAC154 in poplar did not affect SCW thickness but did reduce growth, illustrating that SND2 regulatory functions may differ between herbaceous and woody plants (Grant, Fujino et al. 2010). To better understand the functions of NAC154 and NAC156, we transformed Populus clone INRA 717-1B (P. tremula x P. alba) with an artificial microRNA (amiRNA) targeting both paralogs. In a transgenic field trial, all amiRNA events (amiSND2) showed higher growth than non-transgenic wild-type (WT) controls. We also observed that amiRNA transgenics showed delayed leaf senescence and leaf drop. To further understand the leaf senescence phenotype and its interaction with different environmental variables, we conducted controlled environment studies with two amiRNA transgenic events. Controlled environment study shows that NAC154/156 downregulation does not alter short daylength (SD)-induced growth cessation and bud set, but does delay low temperature-induced leaf senescence and leaf drop. Moreover, amiRNA transgenics show a delayed growth cessation and bud set in response to nutrient deprivation compared to controls. Furthermore, wood chemistry data of field grown trees show that amiRNA transgenic events contain significantly higher mean cellulose compared to the WT.

A Clinical Case Series on the Transdiagnostic Application of Acquire Intensive Neuromotor Rehabilitation

Jessie Mann, 2:00 PM Flash Talk Round, GLC Conference Room F

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Keywords: Neurorehabilitation, Intensity, Pediatric rehabilitation

This oral presentation will include background on the use of intensive neuromotor rehabilitation, which has a long history in adult populations, and its more recent addition to to the field of pediatrics. The specific features of Acquire intensive neuromotor rehabilitation will be presented, along with data on the study population and their functional gains post treatment. Acquire Intensive neuromotor rehabilitaiton, offered out of Virginia Tech's Neuromotor Research Clinic, is a play-based intervention employing the prinicples of intensity and operant conditioning such as shaping, reinforcement, and high dosage. This intervention has been found to be more effective for the treatment of Cerebral Palsy (CP) than the current standard of care, and was one of only a couple treatments given a Green Light for evidence-based efficacy, in an Evidence Alert Traffic Light systematic review of proposed treatments for CP. Following on the efficacy of this therapy for the treatment of CP, it has been applied to, and found to be effective for, disorders such as microcephaly and autism. Continuing this line of research, it was here undertaken to explore the transdiagnostic efficacy of Acquire therapy across various so-called 'orphan conditions'. Children with these rare conditions often receive limited services as there is little to no documented efficacy associated with currently available treatments for there conditions. The children in this case series, diagnosed with Ventriculomegaly, Microcephaly, and Kernicterus, respectively, demonstrated substantial functional gains after Acquire therapy intervention. These gains will evidenced in the presentation through the use of progression video and data analysis. This research is the first step in the study of the efficacy of this intervention across various diagnosis, and may provide clinicians with new perspectives and therapeutic guidance when they encounter other such orphan disorders.

Growth and Survival of Listeria Monocytogenes on Intact Fruit and Vegetable Surfaces: A Systematic Review

Claire Marik, Poster Presentation, GLC Multipurpose Room

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Keywords: Food Safety, Listeria monocytogenes, Intact Produce

Listeria monocytogenes is known to be present in produce associated environments (e.g., fields, packinghouses); thus, it is critical to evaluate L. monocytogenes growth and survival data on intact whole produce surfaces. The goal of this study was to identify and characterize published data on the growth and/or survival of L. monocytogenes on fruit and vegetable surfaces. Relevant studies were identified by searching 7 electronic databases: AGRICOLA, CAB Abstracts, Center for Produce Safety, FSTA, Google Scholar, PubMed and Web of Science. Searches were conducted using the following terms: Listeria monocytogenes, produce, growth and survival. Search terms were also modified, exploded, and blasted to find all related subheadings. Included studies had to be prospective, describe methodology (e.g., inoculation method), experimental parameters, and provide quantitative growth and/or survival data. Studies were not included if methods were unclear or inappropriate (e.g. dip inoculation may promote internalization), and if produce was cut, processed, or treated. Of 3,459 identified citations, 88 were reviewed in full and 29 studies met the inclusion criteria. Studies represented 21 commodities; with the majority of studies focusing on melons, leafy greens, berries, and sprouts. Synthesis of the reviewed studies suggest L. monocytogenes growth and survival on intact whole produce surfaces differs substantially by commodity. Parameters, such as temperature and relative humidity had a considerable effect on L. monocytogenes growth and survival dynamics. Contaminated produce held at ambient temperatures (>20°C) had higher growth rates, compared to contaminated produce held at lower temperatures (4 +/- 2°C, 10 +/ -2°C). This review provides an inventory of the current data on L. monocytogenes growth and survival on intact whole produce surfaces. Identification of which intact whole produce commodities support L. monocytogenes growth and/or survival at various conditions observed along the supply chain will assist the industry in managing L. monocytogenes contamination risk.

Sheathing System xc-: The Double-Edged Sword of Glioblastoma

Joelle Martin, 2:05 PM, GLC Conference Room B

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Keywords: Glioblastoma, Extracellular Matrix, Glutamate

Glioblastoma (GBM) is a resilient and malignant type of brain tumor with a dismal prognosis. Median survival time for patients is only 15 months, despite aggressive tumor resection, chemotherapy, and radiation treatments. Clinical data show that patients with high expression of the system xc- (SXC) antiporter have faster growing tumors and shorter survival times compared to patients with low SXC expression. SXC is responsible for importing amino acids into the cell to make antioxidants, conferring chemotherapy resistance to tumor cells. Additionally, SXC mediates the expulsion of the excitatory neurotransmitter glutamate into surrounding brain tissue. The excess glutamate creates a toxic environment that destroys healthy neurons. Hyaluronic acid (HA) is present in large quantities within the brain, and activates signaling cascades that prevent internalization and degradation of membrane bound proteins. Thus, we hypothesize that decreasing HA concentration with the enzyme hyaluronidase (HAse) will promote the internalization of SXC and result in less glutamate release. Exposing GBM cells to HAse resulted in a pronounced reduction in extracellular glutamate concentration. Furthermore, upon removal of HAse, glutamate levels began to rise. To determine if this reduction in glutamate is due to internalization of SXC, we analyzed the expression of SXC in the cell membrane and observed a reduction in SXC protein expression following HAse incubation. Taken together, these data indicate that HAse treatment decreases both SXC function and membrane expression. Thus, reducing SXC function by inhibiting a HA-mediated signaling cascade has the potential to not only preserve healthy tissue within the brain, but also render tumors more susceptible to medical interventions.

Sluggish Cognitive Tempo (SCT) in Autism Spectrum Disorder: Implications for Comorbidity and Social Impairment

Tyler McFayden, 11:00 AM Flash Talk Round, GLC Conference Room F

Authors: Tyler McFayden, Angela Dahiya-Singh, Matthew Jarrett, Angela Scarpa, Susan White, and Thomas Ollendick

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Keywords: autism, ADHD, sluggish cognitive tempo

Objective
Sluggish Cognitive Tempo (SCT) is characterized by daydreaming, difficulty concentrating, and drowsiness. SCT has most commonly been studied in Attention-Deficit/Hyperactivity Disorder (ADHD), with connections to internalizing disorders and social impairment. Little work has investigated SCT in Autism Spectrum Disorders (ASD), despite shared neurodevelopmental etiologies with ADHD. Furthermore, no previous works have considered comorbid neurodevelopmental conditions and their impact on SCT. This project examines the prevalence of SCT symptoms in ASD, investigates the impact of comorbid neurodevelopmental conditions on SCT, and investigates how SCT moderates the relation between diagnosis and social impairment.

Method
Participants (n = 98, 24 females) included children/adolescents, ages 6-17 (Mage = 10.08, SD = 2.91), with diagnoses of ASD (n = 28), ADHD (n = 46), or ASD+ADHD (n = 24). Parents completed the Child Behavior Checklist, from which the SCT T-score was derived, and the Social Responsiveness Scale, from which the Social Communication Inventory was derived as a measure of social impairment.

Results
Analyses indicated no significant difference between groups on SCT T-score, $F(2, 89) = .581$, $p = .56$, indicating that SCT is as prevalent in ASD as in ADHD and ASD+ADHD. Independent samples t-tests indicated a significant sex difference in SCT symptoms, $t(90) = -2.27$, $p = .025$; females had higher SCT than males. Linear regression analyses indicated significant effects of diagnostic group ($\beta = .488$, $p < .001$), and SCT ($\beta = .401$, $p < .001$) on social impairment, but no significant moderation effect of SCT ($\beta = -.009$, $p = .9$).

Conclusions
This is the first documented investigation of SCT symptoms in comorbid ASD and ADHD. Results indicate that SCT symptoms may be as present and impairing in ASD as in ADHD, and that SCT symptoms contribute to greater social impairment in both neurodevelopmental disorders.

The Colored Sense of Awareness: An Analysis of Race, Power, and Communication in the Workplace

David Mercer, 3:00 PM Flash Talk Round, GLC Conference Room F

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Keywords: Race, Communication, Power, Diversity and Inclusion

The United States has a history that is troubled with racial imbalance and inequality. These problems have led to inequities in various sectors of our society. One of the areas where inequality persists is the workplace. This study examines the relationship between race, communication, and organizational culture. Specifically, it explores African American professional's experiences with race, diversity and inclusion, and the organizational culture of the places they work. It calls to question the manners in which organizations are working to create a more equitable workplace. The specific research questions of the study are: RQ1: How do African Americans perceive the role of race in the workplace?; RQ2: How do African Americans perceive the organizational culture of the organization they work for?; RQ3: What role do African Americans perceive that Diversity and Inclusion programs play in shaping their organizational culture and a more equitable workplace?; RQ4: What role does communication (peer to peer and supervisor to subordinate) play in African American perceptions of their organization's culture? Participants will be African American professionals who are employed full-time at large for-profit corporations. Participants will be interviewed and asked about the communication and Diversity and Inclusion efforts of their organization. The study employs Glaser and Strauss' constant comparative analysis method. The analysis while produce themes that answer the research questions. This is an ongoing project and results have not yet been determined.

Noncanonical NF-κB Signaling in Inflammatory Bowel Disease Associated with Anti-TNF Therapy Responsiveness in Human Patients

Holly Morrison, 10:00 AM Flash Talk Round, GLC Conference Room F

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Keywords: Anti-TNF, Inflammation, Infliximab, Noncanonical NF-κB

Inflammatory Bowel Disease (IBD), collectively referring to ulcerative colitis (UC) and Crohn's disease (CD), is characterized by dysregulation of inflammatory pathways in the gastrointestinal tract. One such pathway is the NF-κB signaling pathway. There are two arms of the NF-κB signaling, including the canonical and noncanonical (aka "alternative") pathways. The canonical pathway has been well evaluated in regard to IBD while the noncanonical arm is relatively understudied. Activation of the noncanonical pathway is initiated by tumor necrosis factor (TNF) family molecules, which ultimately results in the nuclear transcription of chemokines that upregulate inflammation. Infliximab is an IBD treatment that uses anti-TNF monoclonal antibodies to diminish TNF-mediated signaling, which is associated with IBD pathogenesis. Unfortunately, a significant percentage of patients treated with infliximab lose responsiveness to this drug. We show that noncanonical NF-κB signaling mediates IBD pathobiology. Additionally, the expression levels of this arm of NF-κB signaling can be used to gauge infliximab responsiveness. In collaboration with Virginia Tech Carilion School of Medicine, we received 27 IBD patient and 9 non-IBD control tissue biopsies from human patients. We then analyzed the expression levels of the noncanonical NF-κB using bioinformatics. Genes related to the noncanonical NF-κB pathway were significantly upregulated in IBD lesions compared to healthy tissue. IBD patients that are nonresponsive to infliximab had significantly increased noncanonical NF-κB expression levels compared to responsive patients. These results are suggestive that infliximab decreases noncanonical signaling in responsive patients to lessen inflammation, while fails to do so in nonresponsive patients. Therefore, the noncanonical NF-κB pathway has a newfound role in IBD pathogenesis and is a considerable factor to consider when improving IBD drug efficacy.

Cultivating a Healthy School Environment: Evaluation of a Training for Virginia School Nutrition

Rachel Nelson, Poster Presentation, GLC Multipurpose Room

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Keywords: Evaluation, School Nutrition, Childhood obesity

BACKGROUND
One in five school-aged children were considered obese in 2016. The Virginia Department of Education (VDOE) serves approximately 146 million lunches annually, making it a potential target for a nutritional intervention. Cultivating a Healthy School Environment: Nourish and Flourish through Training and Technical Assistance is an initiative through VDOE that offered a training workshop in June 2018 to educate school nutrition directors (SNDs) on strategies to improve their school nutrition programs. The training focused on six target areas: Farm to School (F2S), Culinary Skills (CS), Strategic Planning (SP), Community Outreach and Engagement (COE), Nutrition and Physical Activity Promotion (NPAP), and Menu Planning and Development (MPD).

METHODS
Pre/post surveys were used to evaluate changes in participant self-efficacy for improving school nutrition programs, perceived stakeholder support, and intention to implement each of the strategies in the 2018-2019 school year. Intention to implement strategies was measured on a Likert type scale ranging from one, not likely, to five, very likely. Survey responses for each participant were compared using paired t-tests. A Bonferroni adjustment was used to set the adjusted p-value at 0.0038.

RESULTS
Participants (n=72) indicated they were most likely to implement changes related to the MPD session in the 2018-2019 school year. Intention to implement significantly increased by 0.85 for F2S, 0.83 for CS, 0.70 for SP, 0.55 for COE, and 0.37 for NPAP for each participant following the training ($p<0.001$). Average self-efficacy scores did not significantly increase from pre to post ($p=0.00735$). Perceived support from cafeteria staff was highest among stakeholders on both the pre-survey and post-survey, though the average score significantly decreased from pre to post ($p<0.0038$).

CONCLUSION
Further research will explore the impact of the training session on changes SNDs make to the lunchroom environment over the two-year study period.

Exploring disabled agricultural workers' professional life before and after using assistive technology: Using the Job Characteristics Model

Nesma Osman, 10:00 AM Flash Talk Round, GLC Conference Room F

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Keywords: Disabled agricultural workers, Assistive technology, AgrAbility Program, The Job Characteristics Model-Work motivation.

This study documented the experiences of agricultural workers with disabilities currently using assistive technologies (ATs) through Kentucky AgrAbility Project. Comparisons between work life before and after their use of ATs were made. Moreover, this study explored motivational factors for continuing agricultural work using the Job Characteristics Model as a conceptual framework. In addition, recommendations and ideas for ways to improve disabled agricultural workers' work conditions were also reported. In addition, personal characteristics were identified that affected participants' motivation to continue their agricultural work. The study used a qualitative approach with a purposive sampling method to ensure participants met specific criteria (born with or acquired a disability, diversity of disabilities, and use of ATs for at least one year). Seven participants (two females and five males) completed a questionnaire and were interviewed by telephone. Data were analyzed based on thematic analysis using a deductive approach. The results showed that ATs had a mostly positive influence on disabled agricultural workers' work life and work motivation. Providing additional types of ATs or using primitive tools were suggested for further enhancing disabled agricultural workers' work life; and the more severe the type of disability and related health conditions, as well as aging (i.e., growing older) had a negative effect on work motivation. However, being the owner of the farm or agricultural business positively influenced motivation to continue agricultural work. The study has different implications for administrators of AgrAbility Project and for administrators who are planning a program for disabled agricultural workers in other settings. .

Studying Gene Regulators Essential for the Plant Pathogen Pantoea stewartii to Survive in Corn

Holly Packard, 2:45 PM, GLC Conference Room B

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Keywords: bacteria, corn, wilt, gene regulation

Pantoea stewartii subsp. stewartii is a bacterial plant pathogen that causes Stewart's wilt disease in corn. Endemic to North America, this agriculturally relevant disease reduces crop yield and impacts seed exports. Genes involved in initial leaf water-soaking symptoms, followed by later-stage biofilm formation resulting in water blockage within the xylem, are known factors important to the pathogenesis of P. stewartii. However, much remains to be discovered about in planta specific requirements for the survival and virulence of wilt-disease causing bacteria like P. stewartii. Previous work in our lab utilized RNA-Seq and Tn-Seq approaches to determine what genes are highly expressed and what genes are necessary for its survival within the corn xylem, respectively. Dataset analysis has identified hundreds of genes that are hypothesized to play an essential role for P. stewartii within the xylem. Genes encoding transcription factors (TFs), proteins with regulatory roles controlling other genes, were selected for further work because of their potential influence over gene networks required for the bacterial survival in planta. Among these were two selected to serve as controls for methods development: nsrR (nitric oxide stress response) and iscR (iron-sulfur cluster assembly). Other annotated, but unnamed, TFs were selected to elucidate their role controlling phenotypes important for P. stewartii during infection. Reverse genetics approaches are underway to generate deletion and complementation strains of each chosen gene. These mutant strains will be tested via in planta assays to evaluate virulence and colonization capabilities. Additional studies will identify the genes under control of each TF, as well as crosstalk between the gene networks under investigation. Already, NsrR has been confirmed to play a role in P. stewartii virulence. Ultimately, this work will broaden our understanding of the gene regulatory networks being employed by the bacteria in planta and may reveal possible disease intervention targets and strategies.

Attitudes Toward University Communication: Applying and Extending the Theory of Planned Behavior

Albert Raboteau, 3:00 PM Flash Talk Round, GLC Conference Room F

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Keywords: Communication. Decision-making, Attitudes, Behaviors

Using a survey distributed to alumni of a large, public, mid-Atlantic university, this master's thesis research is testing an extended model of the Theory of Planned Behavior (TPB) in a way that has both theoretical and practical implications. From a theoretical standpoint, it extends the TPB model in order to account for the effects of college experience and university communication on alumni's charitable decision-making. While the TPB is one of the most widely used models for understanding behavioral motivations, and has frequently been applied to pro-social behaviors, it has rarely been applied to charitable giving overall. Meanwhile, the effects of communication with and past experience of receiving services from a charity are not typically integrated into TPB models, but are likely to factor into alumni's charitable decision-making. This research accounts for that dynamic. From an applied standpoint, this research provides insight into a question of great interest to colleges and universities: What factors influence alumni's likelihood to give? This question is becoming increasingly important as alumni giving rates have been declining nationwide.

Towards Reclassifying “Immunogenic Cell Death” as Pyroptosis

Veronica Ringel-Scaia, 3:10 PM, GLC Conference Room B

Authors: Veronica M. Ringel-Scaia, Natalie B. White, Rebecca M. Brock, Sheryl Coutermarsh-Ott, Kristin Eden, Rafael V. Davalos, and Irving C. Allen

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Keywords: breast cancer, ablation, abscopal effect, metastases, immunotherapy

The abscopal effect is the rare phenomenon when localized therapy leads to partial or full tumor regression at a distant tumor site other than the primary tumor. New therapeutic paradigms and treatment strategies are direly needed to eliminate mortality associated with metastatic breast cancer. Inducing the abscopal effect following localized therapy could revolutionize traditionally difficult-to-treat metastatic breast cancer. Although debated, the mechanism associated with the abscopal effect includes the initiation of a loosely defined mechanism known as “immunogenic cell death.” High-frequency irreversible electroporation (H-FIRE) is a novel and emerging tumor ablation strategy. This technique utilizes high-frequency bipolar electric pulses to destabilize cancer cell membranes and induce cell death. Our hypothesis predicts that H-FIRE induces local immunogenic cell death in mammary tumors, promoting both innate and adaptive anti-tumor immune system responses, triggering the abscopal effect. To evaluate this hypothesis, we utilized the mouse 4T1 mammary tumor model. Here, we show that H-FIRE not only effectively ablates the primary tumor, but also significantly reduces metastases. We also show that the dominant form of cell death following H-FIRE both in vitro and in the in vivo orthotopic mammary tumor model is pyroptosis. This was detected by a significant increase in damage associated molecular pattern signaling and increased activation of caspase-1-dependent signaling. Indeed, our data indicates that the level of tumor ablation strongly correlates with increases in signaling pathways associated with the activation of cellular immunity and pyroptosis. Likewise, we show that the decrease in metastatic lesions is dependent on the intact immune system and H-FIRE generates 4T1 neoantigens that engage the adaptive immune system to significantly attenuate tumor progression. Based on these findings, we would like to reclassify the broad definition of immunogenic cell death as pyroptosis, and believe that this reclassification will aid in further immunotherapy for metastatic cancers.

Impact of Slow Steaming on U.S. Imports: Does Time Sensitivity Matter?

Khadija Rouchdi, 1:40 PM, GLC Conference Room B

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Keywords: Slow Steaming, International trade, Gravity model, Shipping, Transportation

Slow steaming (i.e., sailing at a reduced speed) has become a new standard in the ocean shipping industry. The main reason for its popularity among carriers is the cost savings from reduced fuel consumption. Reduced shipping speeds, however, also results in longer transit times, imposing important time costs on shippers (i.e., exporters and importers). Depending on the magnitude of time costs, shippers may consider alternatives to ocean shipping, such as substituting to air transport, or they may completely stop trading. The category of goods being traded is also expected to affect shippers' decisions, since time-sensitive goods are more sensitive to longer delivery. I examine the impact of slow steaming on the volume and composition of the U.S. imports, using U.S. imports and shipping speed data for voyages completed between selected U.S. and international port-pairs between 2006 and 2010. I estimate a set of modified gravity equations using fixed effects method. Results suggest that speed reductions during the study period had a direct impact on trade, with a 10 percent decrease in sailing speed reducing trade by at least 15 percent. The magnitude of this impact is even greater for time-sensitive products, with a 10 percent reduction in speed reducing trade of time-sensitive products by up to 57 percent.

Math and Metaphors: Images Students Use to Understand Abstract Concepts

Rachel Rupnow, 9:00 AM Flash Talk Round, GLC Conference Room F

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Keywords: Conceptual Understanding; Conceptual Metaphors; Abstract Algebra

In an effort to understand ways students visualize isomorphisms and homomorphisms between specific mathematical structures called groups, eight undergraduates from two introductory abstract algebra courses were interviewed. Students in one class had been instructed using the Inquiry-oriented Abstract Algebra materials, in which students were guided to reinvent the standard definition for isomorphism and homomorphism. Students in the other class were taught with lecture two days each week and lab activities on the third day, also with a goal of learning about isomorphism and homomorphism. During interviews, students were given various groups and asked to ascertain whether an isomorphism existed or a homomorphism existed between the groups. Students' statements while solving were analyzed from a conceptual metaphor lens (Lakoff, G. & Johnson, M. (1980). Metaphors we live by. Chicago: The University of Chicago Press.). Conceptual metaphors are a construct for thinking about one thing as if it were another. Students' metaphors grouped into clusters such as around a journey (e.g. an element from group G sent to group H) or sameness (e.g. isomorphic groups are essentially the same). The students experienced varied success in creating isomorphisms and homomorphisms and utilized a variety of conceptual metaphors for isomorphism and homomorphism while solving. Patterns in success and struggles while solving are examined in light of the metaphors students used.

Sweaters for Brain Cells

Ubadah Sabbagh, 3:30 PM, GLC Conference Room D

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Keywords: brain, development, vision, neurons, sensory

Our relationship with the visual world is heavily dependent on our ability to receive and process light coming into the eye. Globally, roughly 1.3 billion people live with some form of visual impairment – making it vital that we learn how visual information is process in the brain. The process begins in the eye, where light is detected by cells in the retina, converted into neural signals, and transmitted into the brain. Roughly in the middle of the brain sits a major recipient of this retinal input - the visual thalamus. While all three of these regions receive retinal input, they each are composed of diverse and unique neurons and molecules, and we are interested in what those molecules are. If the DNA of a cell is an orchestral symphony, then an RNA molecule is a musician and a protein is the music the musician plays. In this study, we systematically analyzed all the musicians in the visual thalamus, as well as their music, to identify any interesting tunes that might play a role in processing visual information. We found an enrichment of specific molecules that live outside of cells, or extracellular, and which are known to make up specialized mesh-like structures that coat neurons in the brain (perineuronal nets). Remarkably, we discovered at least two molecularly distinct types of these structures in the visual thalamus, both exhibiting unique patterns of expression. We also found that if we removed the input of visual information from the eye to the visual thalamus, the expression of coating structures significantly decreased. What this means for how visual information is processed, and how the visual system develops, remains a mystery. However, this study is the first time these coating structures have been shown to possibly play important roles in the processing of visual information.

Polarizable Molecular Dynamics Simulations of c-kit Oncogene Promoter G-Quadruplexes of Distinct Conformations

Alexa Salsbury, Poster Presentation, GLC Multipurpose Room

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Keywords: Molecular Dynamics Simulations, DNA

Guanine-quadruplexes (GQs) are noncanonical DNA structures that are rich in guanine and play fundamental roles in important cellular processes, including genomic stability and regulation of gene expression. These structures are enriched in promoter sequences of growth regulatory genes and proto-oncogenes like c-kit, which is linked to diseases like gastrointestinal stromal tumors, mast cell disease, leukemia. The c-kit promoter sequence is unique as it forms two GQs with distinct conformations, c-kit1 and c-kit2, providing opportunity to perform molecular dynamics (MD) simulations and better understand the interplay between GQ structure and function. In the past, have made valuable contributions to our understanding of GQs but relied on nonpolarizable force fields which have limited accuracy for biomolecules like GQs, where polarization is critically important. To quantify the role of electronic polarization on cation binding and interactions dictating GQ conformational sampling, we performed MD simulations of the c-kit1 and c-kit2 GQs using the CHARMM36 (C36) nonpolarizable and Drude-2017 polarizable force fields. Both force fields have satisfactorily reproduced experimental data regarding standard, duplex DNA and were employed in tandem to contextualize the effects of polarization. Simulations using both force fields resulted in stable GQ-cores but Drude simulations displayed greater stability of functionally important linker and loop regions. The inclusion of electronic polarization also revealed large differences in base dipole moments between GQs and B-form duplex DNA as well as ion binding pathways that were unique to the Drude simulations. Such descriptions of GQ-ion dynamics provide insight into noncanonical nucleic acids for which little experimental data exist and can expand our understanding of the forces underlying nucleic acid dynamics. Such fundamental knowledge can be employed to refine computer aided drug design targeting GQs.

FusoPortal: An online database of Hybrid MinION sequenced, assembled, and functionally annotated Fusobacterium genomes

Blake Sanders, Poster Presentation, GLC Multipurpose Room

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Keywords: Fusobacterium, pathogenesis, colon cancer, genomics, host pathogen

Here we present FusoPortal, an online database of complete Fusobacterium genomes that were sequenced using hybrid MinION long-read sequencing, and assembled and annotated using a diverse portfolio of open-source software. This resource provides the first fully assembled genomes for several strains of virulent Fusobacterium nucleatum, many of which are associated with the development of colorectal cancer. FusoPortal has been initiated with eight complete genomes, of which 7 were previously only drafts that varied from 6-200 contigs. Significant efforts were made to provide data in easily downloadable formats, fostering a powerful and efficient experience for users. We further showcase that FusoPortal is superior for virulence factor identification, and have corrected a significant number of Type 5 secreted autotransporters that are misannotated in UniProt. In summary, FusoPortal is the first database of MinION sequenced Fusobacterium genomes, and this powerful resource will be expanded in the near future to include >25 genomes to aid the scientific community.

A New Twist on Polymer Characterization

Joseph Sarver, Poster Presentation, GLC Multipurpose Room

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Keywords: polymer, high-pressure fluid, experimental technique

Processing polymers, known colloquially as plastics, using high-pressure fluids such as carbon dioxide is an advantageous technique to generate unique porous structures, lower the viscosity in manufacturing, and reduce the amount of harmful solvents used in commercial processes. Recently, at Virginia Tech, a High-Pressure Torsional Braid Analyzer (HP-TBA) has been developed that allows researchers to discover a new perspective on how polymer materials change in the presence of high-pressure fluids. HP-TBA consists of a polymer impregnated pendulum that is housed in a stainless-steel body. The pendulum is externally rotated to induce oscillations in the presence of high-pressure fluids and the manner in which oscillation die out with time are monitored to understand how the polymer softens with pressure and/or temperature. High-pressure processes have existed in the field of polymer science for decades, but this technology will enhance researchers' ability to determine the processing conditions (i.e. temperature, time, pressure) that will be suitable for processing polymers that are exposed in or with high-pressure fluids.

This poster details the development of HP-TBA technology and its impacts in leading to the creation of more environmentally friendly processes. The insights made with HP-TBA are discussed in the context of common household plastics such as food packaging material, plastic insulation material, and fiber optic cable. Additionally, the challenges of building and testing new scientific instrumentation are presented in a successive format from initial idea to collecting data.

Optimizing public health opioid messaging with ChatterGrabber Message Mapping

James Schlitt, 1:40 PM, GLC Conference Room C

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Keywords: social media, public health, opioids, epidemiology

Prescription Opioid abuse has reached epidemic levels within the United States, resulting in over 1,000 hospitalizations and 116 deaths every day. The over-prescription of opioids presents a significant pathway to illicit opioid use, increasing the risks of counterfeit and contaminated drugs to users. A key challenge for public health practitioners is determining optimal strategies for delivering risk-messages and health advisories to drug users. A study was conducted using ChatterGrabber to to assess the utility of Twitter for crafting public health risk messages following an outbreak of fentanyl and fentanyl derivative contaminated percocets in Atlanta, Georgia. 5,406 original tweets were collected from Virginia and Georgia from June 14th, 2017 to February 6th, 2018. From these tweets, 847 were retweeted a total of 3,574 times. Tweets were manually labelled for messages of avoidance, health and legal consequences of abuse, public policy interventions, contamination, and use. Tweeters' were classified as individual, social, law enforcement, organizational, or government. The efficacy of message transmission was evaluated with regards to message type and source to seek optimal timing, sources, intervals, and keywords to promote dissemination via retweets. Results showed law enforcement pages achieved the highest virality for avoidance and policy intervention messages, whereas media pages followed closely with health and legal consequence messages. Future efforts will expand the study to national scale to compare the efficacy of strategies by geographic region, degree of urbanization, and demographic factors and will seek to develop predictive models of views for candidate messages and sources.

Climate Interactions in a Changing World: Assessing the Effects of Warming and Drought on Amphibian Larvae in an Artificial Pond Experiment

Elizabeth Shadle, 11:00 AM Flash Talk Round, GLC Conference Room F

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Keywords: Climate change, experiment, warming, amphibians, development

The world is experiencing anthropogenically driven shifts in climate which are putting multiple pressures on freshwater ecosystems. Understanding how these pressures are interacting, and how those interactions may effect sensitive species, such as amphibians, is important because it addresses the knowledge gap of how species will respond to changing climate factors. To address this question, we designed a study to examine the developmental responses of amphibian larvae to warming temperatures and shorter hydroperiods (drying levels of water in a pond) of larval habitat – both likely results of climate change in the eastern United States. This research addresses two questions: 1) How do warming temperatures and shorter hydroperiods independently effect larvae development of different amphibians? 2) How do the interactions between temperature and hydroperiod effect larvae development of different amphibians? To investigate the role of different climate factors on amphibians I will use mesocosms (artificial ponds). I will evaluate how survivorship, body size, and rate of larval development of two amphibian species, wood frogs (Lithobates sylvaticus) and spring peepers (Pseudacris crucifer), respond to experimentally manipulated temperature and drying. By conducting this study, I will quantify how temperature and hydroperiod interact to influence the development of sensitive species. Understanding how these climate factors could impact amphibian development is vital in being able to predict the potential effects of climate change on these vulnerable species.

Towards a Better Understanding of Soybean and its Root Nodules Microbiome

Hazem Sharaf, 2:00 PM Flash Talk Round, GLC Conference Room F

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Keywords: soybean, diazotrophs, nitrogen fixation, microbiome

Soybean was the most planted agricultural crop in the United States in 2018. It is among the world most important agricultural products due to its oil and protein contents. Microbial communities living in soybean root nodules are pertinent to its successful growth. Some of these organisms, the diazotrophs, can supply their soybean hosts with most of the nitrogen required for growth naturally through biological fixation. This process is sensitive to environmental perturbations such as change to soil water status in response to factors such as drought. In addition, little is known about the full range of these communities and how they associate with different soybean plants and traits. In order to answer these questions, we have been taking two approaches. The first was to plant nine diverse cultivars of soybean under two irrigation treatments. We would then catalogue the full range of bacterial communities including atypical non-nitrogen fixing bacteria through microbiome sequencing. The second approach includes planting a larger 48 accessions of soybean plants from the USDA germplasm collection. The full extent of the microbiome would then be associated with the host soybean genome, to provide more detailed insights on the interactions between the helper bacteria and soybean. This would have the potential to speed up breeding new varieties of soybean that are more efficient in nitrogen fixation.

Role of Epigenetic Modification in Weed Evolution

Gourav Sharma, 11:00 AM Flash Talk Round, GLC Conference Room F

Authors: G. Sharma, J.N. Barney, S. Askew, D. C.Haak, L. Zhang, and J. Westwood

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Keywords: architecture, continuous present, works of art

Modern herbicides are the most successful and efficient tool for weed control but due to widespread and repetitive use of few herbicides mode of action, weeds develop herbicide resistance. Herbicide resistance is the result of a powerful human-driven selective pressure on weeds. Today there are 495 unique cases of herbicide resistant weeds globally comprising 255 species. Two general categories of resistance are target site resistance (TSR) and non-target site resistance (NTSR). TSR mechanisms are well understood and arise from a single point mutation in the herbicide target gene, but those involving NTSR are still poorly understood and could result from several mechanisms. NTSR can confer an unpredictable level of resistance that may also affect response to herbicides with different modes of action, including herbicides not yet marketed. The origin and genetic bases for these resistance mechanisms is not known. The field of epigenetics may contribute to understanding NTSR in that it explains how organisms are able to adapt to various abiotic/biotic stresses through non-sequence based modifications of their DNA, such as changes in methylation status. Sub-lethal weed management practices could lead to epigenetic modifications that may facilitate evolution of resistance, but the role of epigenetic processes in the evolution of herbicide-resistant weeds is still untested. One of the well-studied epigenetic regulatory mechanisms is DNA methylation, which is the addition of a methyl group to cytosine nucleotides in DNA, which turn on or off gene. We are working on the model plant Arabidopsis thaliana, and the common weed shattercane (Sorghum bicolor) to look at changes in DNA methylation patterns due to the sub-lethal dose of herbicides and other common stresses, seeking to understand whether epigenetic changes are shared or unique among stresses. Thus, this project will elucidate the importance of DNA methylation in weed evolution due to herbicides and other management strategies.

The Head, The Hand, and The Heart: The Design Philosophy of Bruce Goff

Francesca A. Silva Hankins, 11:00 AM Flash Talk Round, GLC Conference Room F

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Keywords: architecture, continuous present, works of art

During the early decades of the twentieth century, American architect Bruce Alonso Goff (1904-1982) designed buildings, primarily residential based on his expectation that a close relationship existed between all forms of artistic activity and life. In 1978, four years prior to his death, he wrote “Coda: As an Architect” for the occasion of an exhibition of his art and architecture essentially summarizing his life as an architect and what a work of architecture is. An architect who works with the client and builds with the site provides a “work of architecture,” which accommodates “people and their ways of life and will grow organically from within outward thus becoming its own shapes and forms.” The result will continue to grow for their lifetime. For Goff, architecture was the only art which could be physically inhabited, and as such we should “desire to enter or take part in a work of art in order to make it ours.” Similar to literature, Goff remarked how “we involve ourselves with it while we read … in music we must participate in it, as we listen, if we are to understand it. Thus, the “architect’s works are personal and impersonal … timely and timeless.” Goff ends the short essay proclaiming that he will “continue to ‘maintain my amateur standing’ as a beginner, beginning again and again in the continuous present.” Goff referred to this idea as the “Continuous Present,” adopted from Gertrude Stein’s 1926 lecture, “Composition as Explanation.” This dissertation investigates Goff’s continuous present as his design philosophy as manifested in his architectural and other artistic work.

Can the Eye Tell Cells in the Brain Where to Go?

Rachana Deven Somaiya, Poster Presentation, GLC Multipurpose Room

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Keywords: Astrocytes, Neural circuits, fibroblast growth factor, visual system, interneuron

The visual thalamus is a multifunctional diencephalic brain structure, which plays an important role in receiving, processing, and relaying the image-forming as well as the non-image forming visual functions. Recent studies have shown that neonatal innervation of visual thalamus by retinal inputs plays an instructive role in the recruitment and incorporation of the non-retinal inputs (and cells) into thalamic circuits. Specifically, retinal inputs play an important role in the recruitment of local GABAergic interneurons into visual thalamus but we know far less about the molecular mechanisms underlying this process. Focusing on this issue, we recently explored transcriptomic changes in neonatal mouse visual thalamus that lacks retinal inputs as well as GABAergic interneurons. Using microarray analysis and in situ hybridization (ISH), we discovered that expression of Fibroblast Growth Factor 15 (FGF15) in the mouse visual thalamus is highly dependent upon retinal inputs. In mice lacking FGF15, we observed a reduction in GABAergic interneurons by ISH in visual thalamus, a result that was confirmed using Glutamate Decarboxylase 67-GFP reporter mice (in which thalamic GABAergic interneurons are labelled with GFP). Interestingly, our data also show that FGF15 is generated by thalamic astrocytes instead of thalamic neurons, suggesting a novel role of astrocytes in the development of visual thalamus. Taken together, these results suggest the existence of novel axon-glia-neuron interaction underlying subcortical visual circuit formation.

Impact of Violence, Distress, Discrimination, Support, and Outness on Suicidal Ideation Among Transgender People of Color

Lauren Smithee, 2:00 PM Flash Talk Round, GLC Conference Room F

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Keywords: transgender; racial minority; people of color; violence; intersectionality

Suicidality is a health crisis that significantly burdens transgender and gender non-conforming (TGNC) populations and warrants additional research by HDFS scholars for effective intervention and prevention. Unfortunately, TGNC people of color (POC) are at an even higher risk for institutional transphobia, interpersonal violence, and isolation, known correlates for suicidal ideation. Despite the known risk factors for suicidal ideation, there is a scarcity of research and a lack of clear findings on various intersecting identities and their association with suicidality among TGNC POC. Those living at the margins of social identities often experience the pressure of representing multiple stigmatized identities and compounding experiences with discrimination, violence, and oppression, making TGNC POC particularly at risk for suicidal ideation. The purpose of this project was to explore the question, "How do the associations between interpersonal violence, outness, family support, healthcare discrimination, and psychological distress predict suicidal ideation among TGNC POC?" A structural equation model was developed using a sample of 4,215 Black, Latino, Asian, and multiracial participants from the largest national dataset on TGNC adults, the 2016 U.S. Transgender Survey. Results yielded a strong and significant structural model (RMSEA= 0.0560, NNFI= 0.927, SRMR= 0.0388) and significant, indirect effects throughout the model. In terms of significant direct effects, there were positive paths from psychological distress to suicidal ideation, physical interpersonal violence to suicidal ideation, healthcare discrimination to suicidal thoughts, and a negative path from outness to healthcare discrimination. Findings demonstrate an urgent need for HDFS scholars to utilize an intersectional lens within research to develop profiles of risk and culturally competent intervention for suicidality among TGNC POC.

Computational Analysis of Gene Regulation in Plants

Qi Song, 2:25 PM, GLC Conference Room C

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Keywords: Machine Learning; Plant Genomics; Gene Regulation

Plants modulate complex gene regulation in response to environmental stresses such as heat, cold and drought. Identifying stress-specific gene regulators is important for improving plant growth and crop yield. While conventional experimental approaches can investigate a few gene pathways, computational analysis enables systematic study of gene regulators on a larger scale. Using state-of-the-art machine learning tools, we developed two computational tools to uncover environmental-stress related gene regulators: 1) CoReg, which aims at identifying coordinated gene regulators in large-scale gene networks and 2) ConSReg, which combines heterogeneous genomic data and infers stress-specific gene regulators. We applied CoReg to a gene network of Arabidopsis and our results revealed that many genes tend to coordinate with each other. We also identified many stress-specific gene regulators for Arabidopsis using ConSReg. The results showed that genes can be classified into several distinct groups based on their responses to environmental stresses. Although our investigation mainly focused on plant species, our tools can be applied to any species to study gene regulators under various environmental perturbations. One promising application is to discover important gene regulators for human disease and use them as novel drug targets.

Disability, Accessibility, Research Methods, Researcher Ethics

Martina Svyantek, 9:00 AM Flash Talk Round, GLC Conference Room F

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Keywords: brain, development, vision, neurons, sensory

As an alternative to approaching research projects investigating Disability that could take research beyond more classically recognizable data collection methods such as survey data or interview, I am interested in methods that center accessibility, affordability, and feasibility. I ask, “What would it be like if more work was recognized as research? What if existing barriers to research (such as finances, location, and access to resources) were removed or acknowledged as part of the research process, allowing data to be collected and analyzed outside of the ivory towers of academia? What if Disabled people were recognized as researchers and experts, especially with regards to their own experiences?” I myself am persistently aware of the privilege of performing my own research, as research in and about Disability is so frequently performed “on” or “for” as opposed to “by” or “with”. The methods I am proposing take the motto of Disability activism, “Nothing about us, without us” to heart as a guiding principle. The strategic methodological choices that are developing have instinctively allowed for results that are more reproducible in terms of both the methods and the eventual research findings.

Workload Quantification in Socio-technical Infrastructure Management Systems: Human vs. Autonomous

Taylan Topcu, 2:25 PM, GLC Conference Room D

Authors: Topcu, Taylan G., and Mesmer, Bryan L. 2018. "Incorporating End-User Models and Associated Uncertainties to Investigate Multiple Stakeholder Preferences in System Design." Research in Engineering Design 29 (3): 411–31. DOI: 10.1007/s00163-017-0276-1

Topcu, Taylan G., Triantis, Konstantinos P., and Roets, Bart. "Estimation of the Workload Boundary in Socio-technical Infrastructure Management Systems: the Case of Belgian Railroads.", submitted on 9/25/2018 to the European Journal of Operational Research currently under review.

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Keywords: socio-technical systems; stakeholder preferences; system safety; machine learning; Data Envelopment Analysis (DEA)

Today's infrastructures are complex socio-technical systems that rely on seamless collaboration between humans and autonomous systems for critical decision-making activities regarding their control and management. Socio-technical systems have many internal stakeholders on different levels of the organization and their individual value maximization attempts could drive the enterprise towards undesirable consequences. Traditionally in such systems, safety critical decision-making activities are allocated to a group of humans that are usually denoted as Controllers. Rapidly improving measurement and artificial intelligence technology along with increasing financial pressure on such organizations incentivize high-level managers to increase the role allocated to automation in control and management activities. While increasing automation allows for the centralization of the system, leading to long-term cost reduction, uncontrollable and dynamic characteristics of the network, such as traffic complexity or density, render the use of automation infeasible and require manual control in certain instances. In this paper, we investigate real operational data from Infrabel and use the microeconomic production theory to quantify the workload allocation between humans and autonomous decision-making systems in pursuit of identifying which uncontrollable network characteristics influence the workload distribution. We then establish statistical relationships between Controller preferences regarding the use of automation and contextual network characteristics using machine-learning techniques. We believe this initial step to capture preferences regarding use of automation would allow for an improved understanding of : (i) workload allocation between human and autonomous systems, (ii) Controller preferences that might contradict organizational preferences, and (iii) the design of future accident free infrastructure management systems.

To join or not to join: Coalition Formation In Public Goods Game

Sakshi Upadhyay, 9:00 AM, GLC Conference Room D

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Keywords: Coalition, Public Goods, Social Preferences

Commitment devices such as coalitions can increase outcome efficiency in public goods provision. This research explores the disparity between previous experimental and theoretical results regarding the relationship between the size of the coalition and the benefits of cooperation. Coalitions have the potential to increase cooperation. While typical public goods models depict an inverse relationship between higher benefits of cooperation or marginal propensity of consumption rate (MPCR) and the coalition size, experimental results, as well as the existence of large size international Environmental Agreements (IEA), find the opposite to be true. This research studies the role of social preference in a two stage public good game where, in the first stage, heterogeneous agents first choose whether or not to join a coalition then, in the next stage, the coalition votes on whether its members will contribute. Social preferences are a type of Rawlsian Inequality aversion where payoffs are strictly increasing in both own earnings and the payoff of the least well off member of society. An individual's weight on monetary payoff and social preference is private information. We use backward induction to derive separate stage two contribution thresholds for both the individuals who join the coalition and those who do not. Using this information, thresholds can be derived to determine who will join the coalition in stage one. We find that individuals with stronger social preferences are more likely to join the coalition and vote for the coalition to contribute to the public good. We further show that higher benefits of cooperation leads to more people joining the coalition and contributing to the public good. Increase in benefits of cooperation also translates to higher likelihood of the coalition contributing to the public good. These results hold whether the coalition's decision is determined by a majority voting or a unanimous voting rule.

Inverse Design of 3D Ferroelectric Lattice Materials with Arbitrary Combinations of Piezoelectric Coefficients

Amanda Wei, Poster Presentation, GLC Multipurpose Room

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Keywords: Additive manufacturing, ferroelectric material, lattice material

High-resolution additive manufacturing (AM) enables the creation of micron-scale lattice materials not achievable previously through traditional manufacturing methods. Concurrently, research in ferroelectric materials has gained much interest due to the materials' many modern applications. However, the performance of current state-of-the-art ferroelectric materials and composites is limited by monolithic material properties, elaborate assembly procedures, or sensing capabilities in only two-dimensions. In this work, a methodology for the inverse design of new ferroelectric lattice materials with customizable piezoelectric coefficients {d_31, d_32, d_33} is presented. The relationship between the strut angle (Θ_space) of the lattice and the resulting piezoelectric coefficients is captured analytically, verified numerically, and realized experimentally. Analytical estimates of piezoelectric coefficients are obtained through a volume-averaging method. Finite element modeling is performed to verify analytical predictions. Lattice materials are additively manufactured through projection microstereolithography of a polymer-PZT particle resin, and realization of the desired piezoelectric coefficients are experimentally confirmed. The results of this work demonstrate the possibilities of designing whole families of new ferroelectric materials with diverse piezoelectric coefficients from a single base material.

Caulobacter Utilizes Cell Cycle "Checkpoints" to Adapt to Environmental Factors

Bronson Weston, 10:00 AM Flash Talk Round, GLC Conference Room F

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Keywords: Cell Cycle, Bacteria, Mathematical Modeling, Environmental Signaling

The freshwater bacterium, Caulobacter crescentus, is an oligotroph, spending most of its life under nutrient-poor conditions. To cope with such stress, the bacteria divide asymmetrically, yielding two daughter cells with distinct phenotypes. The 'stalked' cell utilizes a stalk organelle to attach to rocks in its natural environment, while the 'swarmer' cell utilizes a flagellum to move through the water in search of more favorable conditions. Once the swarmer cell has found a nutrient rich environment, it differentiates into the stalked phenotype, latches onto a rock, and commences to progress through the cell cycle. Underlying this intriguing behavior is a complex molecular network of gene-protein interactions (phosphorylation, protein localization, post-translational modification, and genetic regulation). Here we utilize mathematical methods to model the Caulobater crescentus cell cycle and apply dynamic systems theory to demonstrate how the molecular mechanism manifests in "checkpoints". We show how these bacteria localize crucial regulatory proteins so that division yields two cells in different stages of the cell cycle (stalk and swarmer). Finally, we extend the model to explain how Caulobacter utilizes its molecular "checkpoints" to adjust its cell cycle in accordance to nutritional conditions and environmental stresses.

Analysis of Historical Monitoring Data to Understand Current and Future Dynamics of Harmful Algal Blooms

Whitney Woelmer, 11:30 AM, GLC Conference Room D

Authors: Whitney M. Woelmer, Mary E. Lofton, Ryan P. McClure, Bethany J. Bookout, Cayelan C. Carey

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Keywords: harmful algal blooms, time series modeling, management

Freshwaters are increasingly threatened by severe harmful algal blooms (HABs), a result of rapidly changing land use and climate. Consequently, there is a pressing need to understand the dynamics of HABs in order to anticipate when they will occur. We analyzed the dynamics of HABs in Falling Creek Reservoir (FCR), a small drinking water reservoir in Vinton, VA over the course of four years. To determine changes in drivers of phytoplankton, we calibrated an autoregressive time series model using a suite of physical, chemical, and biological monitoring data. Results indicate that major drivers of HABs over the past five years in FCR are different between years, and include various metrics of both meteorological and nutrient variables, as well as measures of inflow to the reservoir. The emergence of interannual variability in forces driving HABs may be linked to management actions implemented in FCR. Given that meteorological and inflow variables can be predicted confidently in advance, our models can now be used to predict when near-term blooms are likely to occur. Ultimately, our work can be used to inform managers and decision-makers about which variables are most important to monitor and enable managers to take preventative measures when a bloom is predicted to occur.

Gender Representation in Sports Illustrated for Kids

Kelsey Wooten, Poster Presentation, GLC Multipurpose Room

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Keywords: Social Cognitive Theory , Sport Media, Advertising, Children

Sport media has been known to be a producer of traditional gender images that reflect inequality between sexes. The purpose of this study is to analyze gender representation in advertising and editorial photographs featured in sport media directed towards children; specifically, Sport Illustrated for Kids. Images and gender stereotypes have been used by advertising companies to pitch products to consumers. Children in particular cannot accurately determine content that is meant to inform and content that is meant to sell. Images have the power to disseminate information about gender appropriate looks, activities, behaviors and more. This study will use content analysis to determine whether editorial and advertising images in Sports Illustrated for Kids reflects actual participation rates of athletic activities based on gender. By analyzing Sports Illustrated for Kids issues from the past decade (N=40), information regarding the magazines representation of women and traditional gender roles and if it has improved can be brought to light. Utilizing scales from Cuneen & Sidwell (1998) and Duncan & Sayaovong (1990), this study can be used to inform and update future research as well as aid current practitioners.

Quantifying Cognitive Workload with Psychophysiology for Spaceflight Applications

Grace Wusk, 9:20 AM, GLC Conference Room D

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Keywords: psychophysiology, machine learning, spaceflight

As next-generation space exploration missions necessitate increasingly autonomous systems, there is a critical need to better detect and anticipate astronaut interactions with these systems. Real-time, objective metrics of crew state will be especially important to assess operational performance and behavioral health during flight. A psychophysiological monitoring approach allows for real-time classification of an operator's cognitive state using features derived from non-invasive biosignals. This study focuses on cognitive workload during a flight-like task using the Multi-Attribute Task Battery (MATB). The MATB is a well-validated tool complete with system monitoring, tracking, resource management, and communication tasks that can be adjusted in frequency and difficulty to simulate high and low workload flight events. The objective of this study is to use biosignals from commercial, wearable devices, specifically the Interaxon Muse and Empatica E4, to discriminate between high and low workload MATB events. The protocol has been approved by the Institutional Review Board. Participants complete 6-minute high and low workload MATB events, following a 3-minute training, while wearing the devices that measure electroencephalography (EEG), electrocardiography (ECG), photoplethysmography (PPG), electrodermal activity (EDA), and skin temperature. After each event, participants complete the NASA Task Load Index for subjective workload ratings to compare to the performance and physiology results. Psychophysiological features extracted from the raw signals include power spectral densities for the delta, theta, alpha, beta, and gamma frequency bands, heart rate, and heart rate variability. Binary classification is performed using logistic regression and support vector machines. This study evaluates the Muse and E4 as low-cost, portable tools for psychophysiological monitoring with MATB. Future work will focus on implementing real-time classification of cognitive workload and on adapting the approach to a higher fidelity, space-relevant simulation.

Development and Testing of Mobile Phone Short Message Service (SMS) Messages to Reduce Sugar-Sweetened Beverage Intake in Rural Caregivers and Adolescents: A Mixed-Methods Study

Maryam Yuhas, 1:00 PM, GLC Conference Room B

Authors: Maryam Yuhas, MS, RD, Kathleen Porter, PhD, RD, Donna-Jean Brock, Annie Loyd MPH, RD, CHES, Brittany McCormick, MPH, Jamie Zoellner PhD, RD

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Keywords: sugar-sweetened beverages, SMS, rural health, adolescents

High consumption of sugar-sweetened beverages (SSB) pose significant health concerns, particularly in health disparate groups, such as rural adults and adolescents. Developing innovative multi-level strategies that target caregivers as the agents of change could be a promising way to improve both, adolescent and caregiver health. SMS has been cited as an effective way to produce positive behavioral outcomes, although not much research has been conducted in rural areas, particularly focusing on SSB intake. The objective of study is to develop a bank of culturally relevant SMS messages intended for rural caregivers that aim to reduce caregivers and child SSB intake. A convergent mixed-methods design was used to systematically develop and test SMS messages with caregivers in Southwest Virginia. In phase one, five focus groups and a card-sorting activity were conducted to explore acceptability, content preferences (tone of voice, audience, liked/disliked phrases) and use of SMS. In phase two, a 5-week SMS pilot trial was used to re-evaluate these constructs and to examine effects on SSB intake and behaviors. Overall, participants (n=33) found the SMS highly acceptable. Caregivers felt the SMS were convenient, more accessible, and easier to read than other means of communication. Additionally, caregivers preferred an empathetic and authoritative tone of voice, as long as it was providing useful strategies, and stayed away from using absolute words (i.e., always, never). The phase two, pre-post SMS pilot trial survey revealed significant caregiver improvements in home environment, parenting practices, and rule making around SSB (all $p<0.05$). Also, SSB intake among caregivers and children significantly improved ($p<0.01$). Findings from this study were used to develop a final bank of messages, which will be used in a future study testing the effectiveness of an SMS intervention of caregivers' SSB-related behaviors.

Using 3D Printing to Embed Liquids into Water Soluble Materials for Timed Release for Pharmaceutical Applications

Callie Zawaski, 2:05 PM, GLC Conference Room D

Authors: Callie Zawaski, Andre Stevenson, Allison Pekkanen, Abby Whittington, Timothy Long, and Christopher Williams

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Keywords: Additive Manufacturing, 3D Printing, Pharmaceutical

Every individual person has a different bio-chemical makeup (varying based on age, weight, gender, ethnicity, and a variety of other factors) that creates different bio-chemical needs with respect to medicine. Personalized medicine is a new, popular idea where dosage amounts and release rates in oral dose medicines are tailored to an individual's bio-chemical needs. Additive manufacturing (AM), also known as 3D printing, enables for automated customized manufacturing on a part-by-part basis, that allows for the scale-up production of medicine with personalized dosage. With AM, both the geometric shape and the printed material properties can be altered to cause the pill to break in a predefine manor. The manufacturing process and tailored geometry provide the ability to tailor drug amount, incorporate multiple drugs into one pill, and customize the dissolution and drug release of an oral dose pill.

Direct processing of medicine via fused filament fabrication, a sub-category of AM, is challenging due to the elevated temperatures (~200+ °C) used in the melt-based process. Temperature above ~100 °C cause most active drug agents to become inactive, thus ineffective. In this work, this limitation is circumvented by incorporating the active ingredients via in-situ embedding into a priori designed voids (as opposed to incorporating the active ingredients into the melt-processed material) protecting actives from elevated processing temperatures. This concept of embedding active ingredients into printed parts is demonstrated by the in-situ deposition of active ingredients in liquid into thin-walled, water soluble, 3D printed structures. The authors demonstrate the ability to tune the release time of the active ingredients by varying the wall thickness of printed parts using this technique.

Towards Sustainable Water Reuse: Mitigation of Bidirectional Solute Flux in Forward Osmosis Membrane Process

Shiqiang Zou, 2:45 PM, GLC Conference Room C

Authors: Shiqiang Zou; Ethan D. Smith; Stephen M. Martin; Zhen He

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Keywords: Water Reuse; Membrane Separation; Wastewater Treatment; Nanomaterials

Membrane separation processes are being developed to address global freshwater shortage, wastewater reuse, and water-energy nexus. Among these membrane processes, forward osmosis (FO) uses osmotic pressure gradient across a selectively permeable membrane to reclaim high-quality water from a low salinity solution (the feed solution, usually wastewater) to a high salinity solution (the draw solution, often a specifically designed salty solution). The reclaimed water can then be used for versatile applications, such as irrigation, food processing, and life support. A key challenge for broader FO application is the membrane failing to be a perfect barrier and induced bidirectional solute flux during the operation, including reverse solute flux (RSF) and forward solute flux (FSF). RSF is defined as the cross-membrane diffusion of solutes from the draw solution (the salty solution) to the feed solution (the wastewater side), and can result in severe loss of draw solutes and further treatment of wastewater before discharging into natural water bodies. FSF is defined as the diffusion of pollutants in feed solution (the wastewater) to the draw solution side (the salty solution), leading to undesirable contamination of final reclaimed water. Herein, mitigation of bidirectional solute flux has been comprehensively investigated by modifying the current FO membrane with novel material, the zwitterion-functionalized carbon nanotubes (Z-CNTs). When Z-CNTs were coated onto the FO membrane, a notably decreased RSF (up to 83.8% reduction) was observed for multiple draw solutes, including NaCl, $NH_4H_2PO_4$, NH_4Cl, and NH_4HCO_3. Similarly, FSF was significantly decreased (up to 100% reduction) in modified FO membrane with fewer pollutants from the feed solution (the wastewater) leaked to the draw solution. This study is among the earliest effort to utilize novel material (Z-CNTs) to solve the BSF issue in the FO process, and the results will promote better membrane development towards enhanced and more sustainable waste reuse.

Hybrid: It's Not Just For Cars Anymore. Buckle Up, Academia.

Kathleen Carper, 11:00 AM Flash Talk Round, GLC Conference Room F

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Keywords: hybrid, education, pedagogy

The role of technology in higher education has changed significantly in the last decade. Traditional learning, or face-to-face learning, is no longer the standard due to the introduction of online learning. Online learning has become far more common, but there is still much debate about which mode is more effective. Within the realm of online learning, there are many terms: blended, asynchronous, online, e-learning, flipped, and more, yet most educators are unaware of exactly what they mean or how to use these methods in their courses. At Virginia Tech, yet another new approach and term has been created: hybrid learning. By definition, hybrid learning is a hybrid of onsite and online learning; however, the parameters of this style of learning are still somewhat undefined. The purpose of this conversation is to help further understand the terminology and role of hybrid learning in higher education to affect the pedagogy of this new learning style.

Images, Spatiality and Modernity: An Iconology-framing Analysis on a Visual Consumerism Case

Yulong Liu, Poster Presentation, GLC Multipurpose Room

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Keywords: visual communication, modernity and space, iconology, framing analysis

As Messaris (1997) contends, pictures in advertising often convey meanings that cannot fully be expressed through words. Scott (1994) agrees, adding that "[i]n rich colors and textures, a panoply of visual messages entice, exhort, and explain" (p. 252). Visual persuasion studies explore the unique visual discourse of advertising. This paper is an exploration to visual persuasion effects in advertising images that connect sense of space and lights. According to Massey (2004), space is the physical embodiment for people's cultural experience -- humans exist, interact, counteract and form experience is possible only when there is physical embedding. Theorizing the ideological roles of visual images, Strunken and Cartwright (2001) contends that visual images are able to impose ideas and values on audience. Massey (1994) even boldly claims that the division of physical space creates different sense of special possessions, which in turn creates power differentials, identity constructions, and hegemony in the social space. In other words, physical space contributes consciousness of spatial possession that eventually cultivates sense of powers, statuses, and identities among people. With inquisition to behavioral effects of visuals, Miniard et al. (1991) find that image capture, record, and recreate realities through frames that encourages consumer behaviors (Miniard et al., 1991).

Images are visual artifacts that constitute, construe and confirm human consciousness, senses, memories and identities (Mitchell, 2004). With an iconological analysis, this paper identifies the visual-ideological communication strategies on which lighting advertisement photos are manufactured. The author argues that visual pictures enable the audience to re-conceptualize space, residential space and office space in particular, via which the imaginations of home, work, life are deconstructed and reconstructed. Linear-lighting pictures, by providing a sense of controlling time, create a sense of modernity and modern life-styles that appeal the audience so ferociously that the audience voluntarily turn themselves into desperate, hedonist consumers.

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The co-chairs also wish to extend their sincere thanks, admiration, and respect to all of our volunteer judges, to the volunteers who made this day possible, and to Chelsea Corkins, GSA Program Chair, for her energy, support, and incredible leadership.