



LS-NSSA/MnDRIVE 2023 Summer Research Internship

MnDRIVE Faculty Mentors

Our faculty recruitment for the MnDRIVE Summer Research Internship is still underway. The list below includes faculty who participated in **Summer 2023**.

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• Romas Kazlauskas.....	3.
Department of Civil, Environmental, & Geo-Engineering	
• William Arnold.....	3.
• Boya Xiong.....	3.
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• Emilie Snell-Rood.....	3.
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• Gillian Tarr.....	4.

Brain Conditions

I. Institute of Child Development

A. Ka Ip

Research Description: D.A.N.C.E (Development, Affective Neuroscience, Culture & Environment) Lab led by Dr. Ka Ip at the Institute of Child Development at UMN focuses on the development of emotion regulation in typical and at-risk populations, examining the ways that cultural contexts shape emotion regulation, and how early adversity and social determinants (e.g., discrimination and neighborhood inequalities) “get under the skin” to confer risk and resilience for developmental psychopathology and health disparities. Our goal is to use this knowledge to inform social policy that aims to reduce racial-ethnic inequalities and advance health equity, and to optimize timing of interventions.

II. Department of Neurology

A. Luke Johnson

Research Description: The Neuromodulation Research Center (NMRC) specializes in research and the treatment of movement disorders, especially Parkinson’s disease (PD) in a preclinical research census. Our novel, device based approach, brings together experts from the fields of neuroscience, engineering, radiology, and neurosurgery in an interdisciplinary team dedicated to bringing next generation therapies from bench to bedside. Interns with the NMRC will have first-hand experience collecting neuro and electrophysiological data from behaving, implanted NHP. Interns will be able to process this data for synthesis and analysis by senior lab staff. The NMRC's internship program is laid out to give newcomers a holistic experience of research: from project design to publication.

III. Department of Neuroscience

A. Esther Krook-Magnuson

Research Description: The Krook-Magnuson examines brain circuits using a range of techniques. A summer intern would most likely be engaged in running mouse behavioral tasks, and performing analysis of recordings using DeepLabCut technologies. A summer intern would also be expected to attend lab meetings and read relevant literature.

B. Geoffrey Ghose

Research Description: Our lab is interested in why we make mistakes. Broadly speaking, we attribute mistakes to a failure to process information correctly, but is that because the information the brain received was poor or that there was noise in the brain that interfered? We have several projects in the lab designed to answer this question using optical imaging, magnetic resonance imaging, electrophysiology, and brain stimulation of the brains of animals while they are engaged in challenging situations in which mistakes are common. Students in the lab would assist in data collection, train animals in these challenging tasks, or analyze brain and behavioral data.

IV. Department of Pediatrics

A. Oscar Miranda-Dominguez

Research Description: Non-invasive neuromodulation, such as TMS, is utilized experimentally to treat several mental health conditions. However, clinical use is limited because of the variability of the effectiveness. A reason for its high variability in effectiveness is because application often ignores individualized functional neuroanatomy. Functional precision mapping can potentially fill this gap by identifying with clinical precision individualized brain networks.

V. Department of Psychiatry & Behavioral Sciences

A. Christine Conelea

Research Description: The Converging Approaches to Neurodevelopment (CAN Lab) has several ongoing studies focused on neurodevelopmental disorders, with an emphasis on youth with Tourette Syndrome/tic disorders, autism, obsessive-compulsive disorder, ADHD, and anxiety. Methods that students could gain exposure to include neuroimaging, cognitive tasks, cognitive training, clinical assessment, video-based behavioral coding, neuromodulation (transcranial magnetic stimulation), EEG, and clinical trials.

VI. Department of Rehabilitation Medicine

A. Manda Keller-Ross

Research Description: There are two projects to choose from: (1) This project is to determine the influence of left vagus nerve stimulation on autonomic function. This study is important for understanding the pathways of which vagus nerve stimulation influences autonomic function, in particular sympathetic function. Several stimulation parameters will be used to stimulate the vagus nerve and gold standard measurements will be used to quantify blood pressure, heart rate and sympathetic function. (2) This project is to determine the influence of epidural spinal cord stimulation on autonomic function in cervical spinal cord injury patients. This study is to determine if epidural spinal cord stimulation improves autonomic function in spinal cord injury patients. We will optimize stimulation parameters for each participant and test autonomic reflexes (head up tilt test) while using gold standard measurements to quantify blood pressure, heart rate and sympathetic function.

VII. Department of Speech, Language, Hearing Sciences

A. Jayanthi Sasisekaran

Research Description: Research work at the Speech Fluency lab has recently extended to involve the study of neural processes supporting fluency speech production. Through various projects we will be studying the temporal dynamics of language planning and speech production.

Environment

I. Department of Biochemistry, Molecular Biology, and Biophysics

A. Romas Kazlauskas

Research Description: Enzymes have natural functions, but they can also be used to manufacture chemicals, thereby eliminating waste and the need for organic solvents. We engineer enzymes to catalyze synthetically useful reactions. The research involves predicting which substitutions would be beneficial, making the enzymes by expression in bacteria, purifying the enzymes and measuring their catalytic activity.

II. Department of Civil, Environmental, & Geo-Engineering

A. William Arnold

Research Description: The research would look at the degradation or detection of organic chemicals in the environment. Many chemicals, such as pesticides and antibiotics, wind up in the environment either intentionally or accidentally. The Arnold group focuses on quantifying these chemicals in water and sediment, assessing the rates of transformation, and developing treatment technologies.

B. Boya Xiong

Research Description: Plastic pollution is a pressing issue to our ecosystem and human health. In particular, these once considered persistent pollutants can break down into small fragments called micro- and nano-plastics that have been found everywhere could cause adverse health effects. Understanding the fundamental processes of how plastic breaks down via coupled photochemical and mechanical mechanisms, as well as developing strategies to recycle plastic into valuable products are both important to mitigate the impacts of future plastic pollution. With novel customized weathering devices and advanced analytical tools, our lab will be able to, for the first time, quantify the fate and degradation of plastics that informs our development of novel plastic recycling technologies and sustainable plastic material design.

III. Department of Ecology, Evolution, and Behavior

A. Emilie Snell-Rood

Research Description: How do heavy metals move through urban ecosystems, and how can an understanding of the ecology of pollutants reduce human exposure to such contaminants? This research involves surveying the soil, plants, and pollinators of urban ecosystems across a gradient of heavy metal pollution. We focus survey efforts on field sites important to urban wildlife (parks, green spaces), and locations where people are benefitting from interactions with urban nature (meaningful cultural sites, community gardens, etc.).

B. Michael Travisano

Research Description: We are excited about the role of microorganisms in affecting water quality, and understanding how to better manage microbial communities. Microbes directly impact water quality by using resources and releasing compounds into water. In addition, microbes indirectly affect water quality by interacting with one another, via predatory, competitive and commensal interactions. The role of microbial interactions in affecting water quality is increasingly important in a (climate) changing

world.

IV. Department of Plant and Microbial Biology

A. Kathryn Fixen

Research Description: In the Fixen Lab, we want to harness the power of microbial physiology to create more sustainable biofuels and bioproducts. Using approaches encompassing bacterial genetics, genomics, and biochemistry, we are developing a photosynthetic bacterium as a biocatalyst capable of using solar energy to power processes involved in bioremediation and production of biofuels and bioproducts.

Global Food Ventures

I. Department of Bioproducts and Biosystems Engineering

A. Bo Hu

Research Description: My research is focusing on the development of bioprocessing technologies to convert agricultural residue and waste materials to value-added chemicals and biofuels. Specifically, we are currently working on a USDA funded project to mitigate the hydrogen sulfide emission in dairy farms; a state funded project to improve feeding quality of oilseed meal from cover crops; and a USDA funded project to utilize food waste for dairy feed in collaboration with University of Pennsylvania.

II. Department of Environmental Health Sciences

A. Gillian Tarr

Research Description: My research group focuses on the epidemiology of foodborne diseases. Several active projects focus on the zoonotic pathogen Shiga toxin-producing *Escherichia coli* (STEC), including an examination of the relationship between risk factors and specific subtypes of STEC, migration of STEC between collocated cattle and humans, and differentiation of local and imported STEC. Other current projects consider enteric pathogens more broadly, including investigating the role of food access in the risk of foodborne disease and predicting the etiology of medically-attended pediatric gastroenteritis.