

2020 Internships Program Descriptions

Please note that program descriptions are subject to change.

Musculoskeletal Biomechanics, with Dr. Walter Herzog and Dr. Tim Leonard

Our lab specializes in musculoskeletal biomechanics. Specifically, we are interested in muscle properties and molecular mechanisms of muscle contraction, and how obesity affects muscles, tendons, ligaments, and joints. We use animal models and sophisticated multi-photon excitation microscopy for much of our research, and also have world-unique equipment systems for mechanically isolating and mechanically testing muscle myofibrils and single sarcomeres. In addition, we do some translational work, particularly as it pertains to muscle properties in children with Cerebral Palsy.

Phenotype predictions and gene mapping via integration of multiscale -omics using statistics and informatics, with Dr. Quan Long

We are trying to migrate the modern machine learning techniques, e.g., deep learning, to medical and biological problems. In particular, we aim to predict disease risk and drug response using genes and other -omics big data. We focus on various diseases including brain diseases and infectious diseases.

Exercise Performance and Adaptations, with Dr. Jalal Aboodarda

Students will have the opportunity to work with Dr. Aboodarda's research team on evaluating neuromuscular (the brain and muscles) and cardiovascular (heart and respiratory systems) responses to different modality of exercise. Students will be provided with explanations about the physiology of the human body and how the integration of physiological and psychological factors determine athletic performance. In Dr. Aboodarda's lab, athletes undertake cycling task to exhaustion, during which O₂/Co₂ exchange, ventilation and heart rate will be measured consistently. Before and after each cycling exercise, the brain and exercising muscles will be stimulated using non-invasive magnetic and electrical stimulation. Also, athletes will be asked to rate their perceived pain, fatigue and effort during the cycling exercise.

Machine Learning, with Dr. Laleh Behjat, Kirill Polzounov and Robyn Paul

This project uses machine learning to first try to model the current knowledge space of a student by asking them a series of questions and then try to predict the type of content to give a student depending on their previous knowledge.

This uses a technique called reinforcement learning. Where you have an agent (can think of as a computer teacher/tutor) that can ask whatever questions it wants from the human student, then it can suggest content (eg notes, videos, etc) and it tries to maximize how much a student learns in a given period of time.

Dance Science, with Dr. Sarah Kenny and Valeriya Volkova

The Dance Science Lab in the Faculty of Kinesiology investigates research questions in areas described as: 'health for dance' and 'dance for health'. The primary focus of Dr. Sarah Kenny's research is set around injury epidemiology, specific to dance and aesthetic sport populations. Objectives are to minimize the risk and reduce the burden of injury in youth dance, sport, and recreation through the development, implementation, and evaluation of primary, secondary, and tertiary prevention strategies. Dr. Kenny's research also explores the psychosocial experience of recreation/community dance as a form of physical activity for other populations across the age spectrum.

Predicting and Preventing Preterm Labor, with Dr. Donna Slater and Kyle Hornaday

The emphasis of our research in the Slater lab is understanding the mechanisms of labor and what happens when this doesn't function properly, which can lead to preterm birth. Currently, we are interested in the following projects: 1) using molecular tools like RNA sequencing and PCR to gain a molecular understanding of the different tissues in the uterus during labor and 2) investigating biomarkers in maternal blood to predict preterm labor. Gaining an understanding of how labor and preterm labor works at a molecular level improves our ability to predict and prevent preterm birth.

Nanotechnology-Based Water Filtration, with Dr. Nashaat Nassar

Dr. Nassar's research ranges from environmental remediation to energy production, to designing and configuring processes for hydrogen production and waste processing to mitigate carbon emission. His work aims to improve oil quality, reduce gaseous emissions and improve water recyclability. His research group utilizes nanotechnology engineering to explore hypotheses related to environmental processes. The project for the STEM Fellowship Internship will involve removing pharmaceutically active compounds from water using nanotechnology. In this project, students will be trained on the synthesis of nanoparticle-based adsorbents and catalysts and use it in a packed bed or photocatalytic reactor for adsorption or decomposing of pharmaceutical compounds typically present in drinking water.

Exploring Postural Tachycardia Syndrome and the Autonomic Nervous System, with Dr. Satish Raj and Kate Bourne

Postural Tachycardia Syndrome (POTS) is a chronic form of orthostatic intolerance. Patients with POTS experience a fast heart rate and severe symptoms while they are standing. POTS is more common in women than men, and is associated with significant quality of life impacts. Our lab's work involves autonomic function testing, using equipment such as an electrocardiograph, continuous blood pressure monitoring cuff, and a tilt table, to try and understand how the autonomic nervous system is disrupted in POTS. By conducting these tests, we can also try to understand the underlying mechanisms of autonomic disorders. Students will have the opportunity to learn about and conduct demo autonomic function tests, perform data analysis and experience the day-to-day work in a clinical research lab.

Photochemistry and Nanomaterials, with Dr. Belinda Heyne

Dr. Heyne's research group is multidisciplinary and her lab uses a combination of light and nanomaterial to solve some of society's grand challenges, such as antimicrobial resistance. Over the week, the student will learn how to synthesize nanoparticles, characterize them using a suite of techniques, and test their properties. The student will also be in charge of analyzing their data and presenting their results at the weekly lab meeting. Working in this lab will provide students with an overview of research in the field of nanotechnology at the University, and a chance to practice communication skills to convey science in a friendly environment.

Understanding oil reservoirs using NMR, with Dr. Apostolos Kantzas

Dr. Kantzas' research group operates a series of laboratories that specialize in challenges related to energy and imaging. The group is a leader in Low Field Nuclear Magnetic Resonance (NMR), Magnetic Resonance Imaging (MRI), x-ray Computed Tomography (CT) applications in heavy oil and oil sands. Students in his lab will learn how NMR works, and how to interpret spectra in different reservoir systems. Participants will also be involved in the group research activities, and will be exposed to different teaching strategies such as lecturing, working with the NMR equipment, analyzing literature, conducting small experiments for investigation of tailings settling dynamics in lab environment.

Language and Cognitive Development, with Dr. Susan A. Graham (Lab Director) and Dr. Elizabeth Morin-Lessard (Post-doctoral Researcher)

The Language and Cognitive Development Lab, directed by Dr. Susan Graham, is part of the CH.I.L.D. research group in the Psychology Department. In the lab, we investigate how infants and preschool-aged children learn new words and develop concepts in order to better understand the world around them. We use game-like studies and advanced technology (e.g., an eye-tracker) designed for children to understand the interactive trajectories of early language, cognitive, and social-cognitive development. Student interns joining the lab will work closely with a Post-doctoral Researcher and other lab members, and will have the opportunity to learn about the research process, run a simulation of an eye-tracking study, and learn about the “behind the scenes” of conducting developmental research.