University of Manitoba 2024 VJKF Projects

Price Faculty of Engineering

Hydraulics and River Ice Engineering

Price Faculty of Engineering:
Shawn Clark and Karen Dow

Join us in the Hydraulics Research & Testing Facility, where we conduct experiments to better understand the complexities of water movement in rivers and on the landscape. Be prepared to get your hands wet as we explore some of the many ways that river ice affects how water and sediment moves in rivers. Don't worry – simulated ice is used in many of our experiments that are conducted at room temperature, so no need to bring along a parka!

Hydrological Evolution: Charting Paths of Adaptation

Price Faculty of Engineering:
Chandra Rajulapati

Hydrology, the study of water movement across various mediums including surface, sub-surface, and underground channels, is continually changing. Such changes present new opportunities as well as challenges. Have you ever pondered the transformation of hydrological patterns over the decades and its profound implications for our environment, society, and communities? Join us for a week in Rajulapati's lab, where you'll delve into the dynamic realm of hydrological changes specific to your region. Gain insight into the consequences of these shifts, and explore the challenges and opportunities, particularly in the context of extreme events such as floods, droughts, and heat waves. Through hands-on exploration, you'll uncover innovative adaptation and mitigation strategies crucial for navigating the impacts of these evolving hydrological extremes.

Wireless Transmission and Metasurfaces

Price Faculty of Engineering:
Puyan Mojabi, Amine Mezghani

This project consists of two parts.
Part 1 is concerned with wireless infrared audio transmission. Advancements in antenna and transmission technologies offer exciting prospects for enhancing wireless network performance, efficiency, and coverage. Dr. Mezghnai's research lab is actively investigating innovative transmission technologies and antenna structures for future radio systems. Part 1 is focused on the development of a prototype for a simple infrared-based transmission scheme. This scheme enables wireless audio signal transmission from a computer to a headset or loudspeaker.

Part 2 deals with tailoring electromagnetic waves. In electrical engineering, we often deal with various forms of circuit designs. In these designs, we typically aim to tailor voltages and currents throughout the circuit. In wireless communications, we use the energy contained within the circuit and create electromagnetic waves (radio waves) using devices known as antennas. These electromagnetic waves then travel in the space around us, thus, enabling applications such as wireless communications, environmental remote sensing, and biomedical imaging. In Dr. Mojabi's research lab, the focus is on tailoring the properties of electromagnetic waves, for example focusing them in one direction and then creating minimum radiation in a different direction. This goal is pursued through the design of thin artificial materials known as metasurfaces that can transform an incoming electromagnetic wave to a desired one.

Accessible Rocket and Space Systems

Price Faculty of Engineering:
Philip Ferguson and Nishant Balakrishnan

Never in human history have we ever had more access to space than we do today. With SpaceX, Rocket Lab, and other commercial launch providers lofting rockets many times per week, communities, companies, and researchers have more access to space than ever before. This is important because of the benefits space platforms can provide for life on Earth, including internet connectivity, remote sensing, and life sciences research. One of the reasons why space is becoming so much more accessible is because of the public outreach that companies are doing. By making rocket and satellite technology accessible and understandable to the general public, there is more support to continue rolling out new missions. Further, with these new missions coming online, there are more and more opportunities to integrate new and emerging technologies into the space industry, such as machine learning and 3D printing.

In this project, students will learn about rocketry, 3D printing, and space systems integration, using hands-on activities. Students will begin by learning about basic model rocketry by assembling two rockets (one small and one large). They will develop safe launch protocols and practice by launching the smaller of the two rockets. For the larger one, they will modify it to include a new nosecone, capable of incorporating a small digital camera. The students will integrate this camera into the nosecone and fly it while collecting video.

The students will then travel to Magellan Aerospace (near the Winnipeg Airport) for a tour of the satellite assembly areas. There, they will get hands-on experience with some typical space systems integration and test activities, including soldering, electronics assembly, vibration testing, and thermal vacuum testing. They will then get a plant tour of Magellan Aerospace, where they will see real Black Brant Rockets being assembled and tested. Students will also see other business units at Magellan, including those for the civil and military aviation industries.

DESCRIPTION TO COME

Faculty of Science

Migratory Landbirds

Faculty of Science
Kevin Fraser

The Avian Behaviour and Conservation lab in the Department of Biological Sciences conducts research focused on the movements and timing of long-distance migratory landbirds. Students enrolled in The Verna J. Kirkness Program would join our spring-summer field research team and visit local breeding colonies of the purple martin – a songbird species that migrates 10, 000 km between the Brazilian Amazon and Manitoba. Students will learn avian research techniques as they help to observe, capture, and band birds as well as monitor nests and collect GPS tracking devices that the birds have carried over the past year.

Plant-fungal Interactions

Faculty of Science
Az Klymiuk

The Klymiuk Lab focuses on plant-fungal interactions, often in wetland settings. Plant-fungal interactions can range from symbioses, where both plants and fungi benefit from living in intimate association with one another and exchanging resources, to parasitic or pathogenic interactions, where fungi diminish plant health. During your week in the Klymiuk Lab, you will explore the diversity of symbiotic fungi present in a variety of wetland soils, gaining skills in microscopy-based fungal identification, with options to learn some culturing and standard microbiology bench techniques.

Cosmic Rays and the Aurora

Faculty of Science
Juliette Mammei

Have you ever wondered, “What are we made of?” In this lab you will learn about the most fundamental particles that we are made of, in fact, what “everything” is made of! You will also learn about the forces that determine how these particles interact with each other. You will learn about how we see things that are so small, or so far away, that we can’t see them with our eyes alone. During the week you will measure the charge and mass of an electron, test the effectiveness of radiation shielding, and more – ending the week by building a detector that will allow you to see cosmic ray tracks! You will learn how fundamental particles affect our lives from radiation and its effects to the difference between cosmic rays and the aurora.

Antibiotic Resistance in Bacteria

Faculty of Science
Ayush Kumar

Students will learn about antibiotic resistance which is considered a significant threat to human health in the 21st century. Students will carry out hands-on experiments to observe how DNA transfer from one bacterium to another can result in antibiotic resistance. They will culture bacteria and extract DNA and then analyze it using gel electrophoresis. Students will also learn about the prevalence of antibiotic resistance in the environment, particularly in the drinking water from First Nation communities.

Faculty of Agriculture and Food Science

Baking a Better Bread

Faculty of Agriculture and Food Science
Cristina Rosell

Would you like to design a new food product? Or learn how to develop different foods from grains or pulses. Join us in our lab where we will guide you through the steps that go into creating healthy and nutritious food products. You will learn how to analyze what is in the market and how to select a target food. We will show you how to mill grains or pulses into flour and how those flours have different characteristics. Together, we will explore the science behind dough-making and learn about the equipment used to analyze dough properties. And finally, you will have a chance to put your hands into the dough to make bakery goods, like bread or cakes. Learn about grains and pulses while having fun!

Foods for Health

Faculty of Agriculture and Food Science
Harold Aukema

Students will be hosted by a team of researchers at the Canadian Centre for Agri-Food Research in Health and Medicine (CCARM), dedicated to investigating and understanding the potential health-related benefits found in nutraceuticals, functional foods, and natural health products (health food). Students will experience lab procedures and see what graduate students do. For example, students could do a protein assay, or prepare samples for nuclear magnetic resonance or Mass Spectrometry analysis and learn about the concepts of repeatability, precision, and accuracy. They will also shadow graduate students, learn how nutrition works in relation to disease states (e.g diabetes, brain damage with Fetal Alcohol Spectrum Disorders), and learn how functional vegetables are developed with high agricultural technology.

Losing Ground - How Soil Erosion Works

Faculty of Agriculture and Food Science
David Lobb

Exciting new opportunities are available for Indigenous students interested in understanding soil erosion and sedimentation within the land and waters of Indigenous communities in Manitoba. Working with scientists and community members, you will design and carry out research studies. You will be trained in making observations in the field, using sampling equipment and handling samples, making measurements in the field and in the laboratory, and analyzing data and presenting results. Specifically, you will participate in the assessments of soil erosion on the land, assessments of sedimentation rates in water bodies, and the sourcing and tracking of sediments within waterways, all using environmental radioisotopes and other complementary methods.

(Bio)plastic from Bacteria

Faculty of Agriculture and Food Science
Warren Blunt

Plastics are very durable and versatile materials and their production has risen sharply since 1950. Each year, the world currently produces about 450 million tons of plastic, and unfortunately, we aren't very good at disposing of it. Only about 9 percent of the plastic we produce is recycled. Some is landfilled, but each year 1-2 million tons end up in the oceans, posing a threat to natural ecosystems. A potential solution is to make plastic that is biodegradable. Certain species of bacteria have the ability to make polyesters from renewable material as a way to store energy. These polyesters can be used as biodegradable alternatives to petroleum-derived plastic. During your time in the laboratory, through hands-on experience, you will learn about bacteria that synthesize bioplastics, how to grow them, and how to produce and process bioplastics from bacterial biomass.

Turn Sunflower Meal into Tofu

Faculty of Agriculture and Food Science
Jim House, Amanda Sa

As people's dietary preferences shift, there is a growing demand for sustainable plant-based alternatives. In this project, we are seeking to produce innovative and nutritious foods with sunflower meal, an underutilized co-product of the oilseed industry. In the food processing lab, you will get hands-on with the tofu production process using a unique patented method, from grinding the oilseed cakes to pressing curd into a tofu-like product. You will also develop your analytical skills by assessing the product's nutritional and quality properties, analyzing dry matter and protein content and exploring sensory evaluations. Your work will help address the underutilization of Manitoba's oilseed meals and foster skill development in sustainable food innovation, aligning with the global shift towards more environmentally friendly dietary choices.

Linking Indigenous Crop Production Systems of Canada and Africa

Faculty of Agriculture and Food Science

Martin Entz, Laetitla Mukungu, Sasha Loewen, Michelle Carkner, Julia Beechinor

The project will demonstrate to students that indigenous cropping systems that used to be practiced in the Americas (including Manitoba) were also the indigenous systems of pre-colonial Africa, and that these systems are now being promoted as climate-smart, sustainable systems to achieve food and nutritional security in several East African countries. In a classroom setting, you will learn about the similarities between the ”3- sisters” cultivation method in indigenous communities in Canada and Africa. Then you will get hands-on experience by planting maize (corn), beans and squash in a 3-sisters arrangement at the Glenlea Research Station or the Plant Science greenhouses.

Seeing Plants from the Sky

Faculty of Agriculture and Food Science

Dilshan Benaragama

The Digital Weed Ecology Lab specializes in the creation of tools designed to enable farmers to monitor the growth and development of both crops and weeds by utilizing remotely gathered data via drones. This information is then leveraged to enhance decision-making processes aimed at optimizing crop yields. Our lab activities encompass both fieldwork involving plot-based research and the utilization of computer software for the comprehensive analysis of collected data. Through participation in our program, you will gain hands-on experience in drone operation, data collection, and analysis methodologies. Furthermore, you will receive training in the execution of field research experiments at the Carman research field. Ultimately, you will develop a deep understanding of the processes involved in drone image processing and data collection within computer systems in our lab.

Discover the Role of Animals in Sustainable Food Systems

Faculty of Agriculture and Food Science

Kim Ominski

Do you enjoy learning about animals and want to know more about how livestock contribute to sustainable food systems? If so, then join the team of scientists in the Department of Animal Science to learn more about their research to provide nutritious feed, improve animal production, health and welfare while at the same time reducing the environmental footprint of our food systems. While in the Department you will have the opportunity to learn how precision agriculture can be used on dairy farms, how enzymes can be added to feed to improve growth and environmental sustainability, and how drones can be used to map grasslands. In our microbiology lab, you will have the opportunity to explore the fascinating role that microbes play in digesting feed. You will also join our biochemistry team to examine how essential oils can be used to improve animal health. While working with our behavior team, you will join in on projects assessing the welfare and emotions of cows and piglets. Finally, you will visit our state-of-the-art swine, dairy and poultry operations located at the Glenlea Research Station!

Insects Everywhere

Faculty of Agriculture and Food Science

Kateryn Rochon, Kyle Bobiwash, Alejandro Costamagna, Jason Gibbs

Insects are everywhere, but we rarely notice them. So, what is around us, anyway? Join the Department of Entomology and learn by building your insect collection! During your stay, you will work with insect experts and learn about pollinators, the “good” insects that attack the “bad” ones, and insects that affect animals. You will go to different habitats on and off campus and learn to collect insects using various traps and techniques. Then, you will learn to prepare your insects to preserve them properly and label them like real research specimens. Finally, you will learn how to identify the insects you collected. After a week with us, you will be able to continue exploring the world around you and keep building your collection wherever life takes you.

Farm to Form: A Sustainable Food Journey

Faculty of Agriculture and Food Science
Inoka Amarakoon, Joanne Thiessen Martens, Afua Mante, Xiaopeng Gao, Henrique Carvalho, Nasem Badreldin, Maneka Malalgoda, Nandika Bandara, Narendra Malalgoda

In our journey toward sustainable food production, we aim to supply people with nutritious and plentiful food while safeguarding our natural ecosystems. Over the course of a week, you will be introduced to research across various aspects of food production systems. Starting in the field, we’ll observe both agricultural and natural landscapes, gather soil samples, and explore how drones can offer insights into sustainable land use. Upon returning to the lab, you will analyze crucial soil properties, uncovering their impact on crop yields and the environment. We’ll delve into the transformation of grain crops into the foods we consume and explore the logistics of their transportation. Additionally, you will have the opportunity to bake delightful treats. Connecting the dots, we will discuss the interrelationships among each component of the agricultural production system and their relevance.

Wheat Breeding and Pathology

Faculty of Agriculture and Food Science
Curt McCartney

Learn about wheat, plant pathogens, and crop breeding in the lab and field research plots at the University of Manitoba. Our team develops new winter wheat varieties for production across western Canada. At the end of May, we are busy producing inoculum of the fungal pathogen Fusarium graminearum (cause of Fusarium head blight = FHB), inoculating field trials with F. graminearum and rust pathogens, and taking measurements of wheat traits in our field trials. Later in the season, we assess resistance of our new wheat breeding lines to FHB and rust diseases, heading date, maturity, and grain yield (amount of grain harvested per acre). We are investigating the use of drone-mounted sensors (multi-spectral cameras and LiDAR sensors) to increase the accuracy and efficiency of data collection in the breeding program. You will be exposed to the various activities ongoing in the wheat breeding program. This project will be a hands-on experience with considerable time spent outdoors.

Clayton H. Riddell Faculty of Environment, Earth, and Resources

Deciphering Earth’s History using Rocks

Clayton H. Riddell Faculty of Environment, Earth, and Resources
Ricardo Silva

In the BETY Lab, our research focuses on the physical, geochemical, and biological mechanisms controlling the production and preservation of organic matter at geological time scales and the impact of organic productivity on global elemental cycles and planetary-scale climatic and biological crises. I am looking for students eager to tackle big research questions and interested in understanding how our oceans control environmental change at various time scales. On the other hand, you will learn and develop new skills relating to laboratory work and data analysis and be part of a broad research group focusing on sedimentology and paleontology.

Coastal oceanography - examining land-sea interactions

Clayton H. Riddell Faculty of Environment, Earth, and Resources
Zou Zou Kuzyk, Tim Papakyriakou, Jens Ehn, Kristina Brown, Eric Collins, and C.J. Mundy

The coastal oceanography group at the University of Manitoba seeks to understand how water flows and connects the land and ocean. We are observational scientists, meaning that our work is largely field based, involving data collection focussed within Hudson Bay and James Bay and their watersheds. Typically, we follow carbon flow through the system from the atmosphere (e.g., the greenhouse gas, carbon dioxide) to its dissolved forms in the freshwater and oceanic environment. This dissolved inorganic carbon is then taken up through biological processes (e.g., photosynthesis) to form organic molecules such as carbohydrates that provide the energy to run ecosystems. Ultimately, some of the carbon is buried at the bottom of the ocean, essentially locking up carbon from the atmosphere over very long periods of time. In the group you will learn about these various processes and how they operate in the coastal oceanic environment as well as the tools we use to observe the system.

DESCRIPTION TO COME

Dr. Gerald Niznick College of Dentistry

The Tooth About Dental Hygiene

Dr. Gerald Niznick College of Dentistry
Kathy Yerex

Dental hygienists are the 6th largest regulated health profession in Canada. During your week at the School of Dental Hygiene, you will learn how and why dental hygienists call themselves clinicians, educators, health promoters, researchers, and life savers. Dental hygienists work in various settings and are important healthcare team members. You will learn about dental hygienists; their vital role in preventing and treating oral disease and how having a healthy mouth impacts your overall health. You will have the opportunity to explore and experience the diversity of a career in dental hygiene and the rewards associated with the profession. Here's your chance to discover what the dental hygiene profession is all about; you will be surprised by what this career offers.

Dental Health and Taste Perception

Dr. Gerald Niznick College of Dentistry
Prasheen Chelikani

Your mouth is a gateway to your body and has a significant impact on your health and well being. Dr. Gerald Niznick College of Dentistry is home to a diverse group of professions whose goal is to optimize and improve oral health. During your week with us, you will learn about the vital role of dental health and its effects on your overall health. You will hear from experienced dental experts and researchers who will reveal the important role their profession has on promoting oral health, disease prevention and therapeutic relief. You will gain first hand experience in research on taste genetics and learn about the

interactions between taste perception, food habits and oral microbes. This experience will provide you with insight into the many aspects of the oral health profession and opportunities that are present within it.

Faculty of Kinesiology and Recreation Management

The Study of Human Movement

Faculty of Kinesiology and Recreation Management
Cheryl Glazebrook, Veronica Silva, Jonathan Singer

Students will be able to explore and engage with the Perceptual Motor Integration Lab (Dr. Cheryl Glazebrook) and see the interconnectedness of human movement analysis with the Vision & Mobility Lab, (Dr. Veronica Silva) and the Biomechanics of Balance and Mobility (Dr. Jonathan Singer). This will provide students with a sense of how our human movement analysis labs collaborate to create a holistic understanding of human movements, including the interconnections with different research areas within Kinesiology. Throughout the week, students will have the opportunity to learn about the field of Kinesiology and human movement, including learning how to use various types of equipment and data analyses to measure how humans move, including how we learn and adapt our skills with practice and training. During their time at FKRM, students will be the ability to learn how:

- We can use sound and vibration to improve movement performance, including different methods for measuring improvements.
- Ultrasound tells us about the shape and function of muscles and other tissues during movement, and
- Electromyography tells us about how much a muscle helps move us, and what happens when they get tired.
- Electrocardiogram tells us about heart activity and how heart rate changes during exercise.
- Metabolic cart tells us about your respiratory system and how breathing and oxygen consumption change during exercise.
- Spirometry tells us about your lung function.
- We use research in practice, including how to best train athletes for performance, and how to create novel programs that can improve balance and motor skills for older adults.

Students should wear, or bring, active wear (shorts, t-shirt, runners) with them so that they can put some of the equipment on to learn about how they move!