



UM | Faculty of Agricultural and Food Sciences

Undergraduate Research Opportunities in the Faculty of Agricultural and Food Sciences

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DEPARTMENT OF AGRIBUSINESS & AGRICULTURAL ECONOMICS

[DR. DEREK BREWIN](#)

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Dr. Brewin is the Head of the Department of Agribusiness and Agricultural Economics at the University of Manitoba. His recent research has focused on spatial grain and oilseed markets as well as innovation in food processing and plant breeding. This summer he is planning to work on the economics of grain transportation with a focus on railway movements from the prairies to port position and the bargaining positions of rail and grain handling firms.

[DR. RYAN CARDWELL](#)

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Dr. Cardwell's research interests include the economics of food policy, international trade regulation, and foreign aid, with a focus on international food aid. Current research topics include understanding support for economic policies, the effects of tariff barriers on international food assistance, and the effects of regulation on productivity.

[DR. CHARLES GRANT](#)

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Dr. Grant's research is in the field of digital agribusiness and it involves the development of artificial intelligence (AI), machine learning (ML), and deep neural networks (DNN) to solve agricultural production and processing problems.

DEPARTMENT OF ANIMAL SCIENCE

[DR. MEAGAN KING](#)

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This upcoming summer, Dr. King and her MSc student are running a research trial with piglets looking at two different ways to reduce aggression and improve their welfare: 1) giving piglets burlap as a form of enrichment, and 2) socializing piglets with different litters early in life, in groups of 2 or 10 litters compared to just one. They will examine whether these different housing treatments improve piglet welfare by recording their growth rates, behaviour, and lesions that result from aggression.

[DR. KARMIN O](#)

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Dr. O's team is currently conducting research into the scientific basis of natural products in disease prevention and management in humans and animals with focus on oxidative stress, inflammatory response, nutrient absorption, and metabolism. Their laboratory uses multidisciplinary approaches to investigate health related effects of nutraceuticals, functional food, and herbal medicine. Specifically, we investigate the biochemical and molecular mechanisms of the beneficial effects of various extracts and compounds in multi-experimental models including: (1) antioxidant properties using the in vitro and in vivo assays, (2) inflammatory responses by measuring biomarkers to detect inflammation in humans and animals at the molecular, protein and gene levels, (3) regulation of dietary nutrient absorption in the gut, and (4) functional evaluation including blood parameters, lipoprotein profile, enzyme activities, cardiovascular, liver and kidney functions.

Potential URA research projects - 2022

- Impact of oxidative stress and antioxidants in health and disease progression in humans and animals with focus on nutrient absorption and metabolism in the gut and liver;
- Regulation of inflammatory response and lipid metabolism in metabolic disorders (fatty liver disease, hyperhomocysteinemia, diabetes, obesity) and cardiovascular disease;
- Prevention and treatment of ischemia-reperfusion induced acute kidney injury (AKI) and chronic kidney disease (CKD);
- Beneficial effect of folic acid supplementation, berberine, tyrosol and other compounds isolated from agricultural products and herbal medicine in health.

[DR. KIM OMINSKI](#)

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Adverse weather conditions leading to low forage yield and/or delayed forage harvest can result in low feed availability for Canada's cattle herd. Recently, the cattle sector has witnessed shortage of traditional feedstuffs with increased availability of alternative feed resources due to crops which have failed to meet human consumption standards, as well as increased by-product availability associated with increased regional processing of legumes and cereal grains. Increased demand for plant based proteins/meat substitutes such as peas is expected to grow due to increased diversity of the human diet. Further, processing of fruits and vegetables, including those that fail to reach the quality grade required for human consumption, leading to losses of more than 30%, are also available for inclusion in livestock diets.

DEPARTMENT OF ANIMAL SCIENCE Continued...

Effective utilization in beef cattle diets can lead to decreased feed costs, improved animal performance, decreased land use and the potential to reduce GHG emissions through improved rumen metabolic efficiency and re-direction of by-products from landfills, as well as increased public trust.

Project Objectives:

The following areas regarding use of novel crops/by-products and food waste will be examined:

- 1) Characterization of the nutrient profile– literature review:
- 2) Potential utilization in cattle diets to determine inclusion rate, intake, and performance – literature review
- 3) Resource use efficiency including land use when included in diets in lieu of traditional dietary ingredients including barley and corn – modeling using HOLOS software
- 4) Development of knowledge transfer resources that serve to quantify the role of cattle as "up-cyclers" including quantity of by-products redirected from landfills, resource allocation including land use, food vs feed utilization

DR. CHENGBO YANG

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Project 1: Reducing the environmental impacts of swine production using a novel feed formulation strategy aimed at improving production efficiency of sows by improving the nutrient utilization, number of weaned piglets and gastrointestinal health. The objective of this study is to (1) expand and refine the existing technology that was developed to sows, (2) meet the specific needs of reproductive sows and (3) further improve the environmental sustainability of Manitoba pork production.

Project 2: Effects of functional feed additive supplementation on growth performance, nutrient digestibility, intestinal morphology, microbiome, and fecal score in broiler chickens under high stocking density. Growth promoting antibiotics (GPAs) have been used in poultry production for almost eight decades to increase productivity and efficiency. With increasing public pressure to eliminate GPAs, reliable and effective antibiotics alternatives are urgently needed. We hypothesized that the supplementation of functional feed additives, in this case, benzoic acid and myristic acid would exert beneficial consequences on broilers, and the objectives of this proposal is therefor to evaluate the effects of dietary myristic acid and benzoic acid supplementation on growth performance, nutrient digestibility, intestinal morphology, microbiome, and fecal score in broiler chickens under high stocking density.

DEPARTMENT OF BIOSYSTEMS ENGINEERING

DR. YING CHEN

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Research Interests: Soil-tool-material interactions associated with tillage & seeding machines; processing of agricultural fibres.

Potential URA Project: Weed control for crop production using a non-chemical method (mechanical weeding)

DR. NAZIM CICEK

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Research Interests: Treatment of livestock waste, municipal wastewater, and industrial wastewater. Production & utilization of biomass.

DR. CHYNGYZ ERKINBAEV

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Research Interests: Smart technologies in food process engineering.

DR. FUJI JIAN

Fuji.Jian@umanitoba.ca

Research Interests: Studies of insect biology; detection and control of insects & moulds; grain physical properties, grain drying, mathematical modeling of the stored-grain ecosystem.

Dr. Jian's research currently focuses on mathematical modelling of: 1) insect population dynamics with enough space for their movement and under fluctuated temperature and moisture conditions; 2) distribution of dockage, foreign and fine materials; and 3) temperature and moisture content (relative humidity) inside stored bins.

DR. DAVID LEVIN

David.Levin@umanitoba.ca

Dr. Levin's research is focused on biotechnologies for sustainability including biofuels, biodegradable polymers, bioremediation, microbial and enzymatic degradation of synthetic polymers, and microbial production of antioxidants. His research is multidisciplinary integrates microbiology, biotechnology, and genome sciences with bioprocess and biosystems engineering.

Potential URA Project:

1. Physical-mechanical-thermal properties, applications, and biodegradability of renewable biodegradable polymers, such as Polyhydroxyalkanoates (PHAs and PLA)
2. Physical-mechanical-thermal properties, applications, and biodegradability of petroleum-based, biodegradable polymers, such as Polyethylene succinate (PES), Polybutylene succinate (PBS), Polycaprolactone (PCL), and Polybutylene Adipate Terephthalate (PBAT)

DEPARTMENT OF BIOSYSTEMS ENGINEERING Continued...

[DR. SONG LIU](#)

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Research Interests: Surface engineering of polymeric materials for medical and biomedical applications (surgical drapes, catheters, vascular grafts, ligament & tendon prostheses) to enhance biological interactions.

[DR. DANNY MANN](#)

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Research Interests: Ergonomics of agricultural guidance systems; remote supervision of autonomous agricultural machines; safety issues associated with agricultural machines.

Potential URA Project: Previous research projects have been completed which have provided compelling evidence that real-time visual information should be incorporated into the design of an automation interface for the task of remotely supervising an autonomous agricultural machine. Anecdotal evidence suggests that real-time auditory information is also used by an operator who is physically present on the agricultural machine. Therefore, it is reasonable to conclude that auditory information might also be a useful addition to an automation interface for the task of remotely supervising an autonomous agricultural machine. Rather than transmitting the sound directly to the automation interface, however, it is envisioned that it would be more efficient to use machine learning techniques to classify sounds present on the operating machine and simply notify the automation interface of any changes in status. Furthermore, it should be possible to adjust the functioning of the machine based on classification of the sounds. The specific project that is envisioned for the summer of 2022 is to prepare instrumentation for collection and classification of sounds from an operating combine harvester. There would be opportunity to participate in data collection when harvest begins in August.

[DR. JASON MORRISON](#)

Jason.Morrison@umanitoba.ca

Research Interests: Biofibre collection, separation, and grading of all stages using imaging, spectroscopy, and mechanical assessment. Material properties assessment of biologically sourced and/or bio-compatible materials.

[DR. JITENDRA PALIWAL](#)

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Research Interests: Infrared spectroscopy and electromagnetic imaging (visible, near-infrared hyperspectral, radio frequency, and X-ray) for quality assessment of raw and processed food products.

Potential URA Project: The micro-structure of cereal grains and pulses changes as they undergo various pretreatments (e.g. roasting, soaking, etc.) prior to milling/processing. Various studies have investigated the potential of X-ray micro tomography to model the micro-structure of food products. However, there are very few studies that have attempted to investigate the potential of this technique for studying the micro-structural changes of whole seeds. A well-structured study in this area is warranted.

DEPARTMENT OF BIOSYSTEMS ENGINEERING Continued...

Another project is to use single and dual-wavelength lasers to manipulate the cellular structure of seeds and investigate if laser biostimulation is a viable technique to reverse the loss of germinability due to mechanical damage and/or disease.

[DR. MASHIUR RAHMAN](#)

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Research Interests: Development of natural textile fibres; sustainable textile processing.

Potential URA Project: Processing of flexible materials is responsible for 20% of world's industrial water pollution. A recent report from the United Nations Environment Programme (UNEP) revealed that it takes about 3,781 liters of water to make a pair of jeans. Further, this industry is also responsible for 10% of annual global carbon emissions, more than all international flights and maritime shipping combined.

Researchers in the Department of Biosystems Engineering have successfully extracted a fibre - that has similar properties of cotton except softness - from the waste stream of cattail plants. Cattail plants grow naturally in Canada, particularly in the Prairie regions, in bog and fen, lacustrine marshes, pothole marshes, roadside ditches, riverine marshes, tidal marshes, and wet meadows.

While the majority of cattail fibre's properties are of technical grade, however, cattail fibres are stiffer than the two most widely used fibres (polyester and cotton) which are used for industrial (medical applications) and non-industrial (defence clothing) applications. In its current state of flexural rigidity, cattail fibre is not suitable for processing fine linear density spun-materials that is required for implants and other industrial applications.

Their previous research shows that cattail fibre contains calcium oxalate plates in the structure, and it is believed that these plates are partly responsible for fibre stiffness. The objective of this research is to remove the calcium oxalate plates either by chemical treatments or ultrasonification.

[DR. R. SRI RANJAN](#)

Sri.Ranjan@umanitoba.ca

Research Interests: Irrigation; drainage; remediation of contaminated soils & groundwater; instrumentation for soil & water monitoring.

Potential URA Project:

1. Building and calibrating soil moisture sensors for installation in the field.
2. Measuring the rootzone moisture uptake pattern of field crops to determine optimum subirrigation design parameters.
3. Building and evaluating aeroponic systems with recycled materials from households.
4. Evaluation of different crops in aeroponic systems to determine the optimum irrigation schedule.

DEPARTMENT OF BIOSYSTEMS ENGINEERING Continued...

DR. JILLIAN SENIUK CICEK

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Research Interests: Engineering education; assessment, evaluation & measurement of learning outcomes; investigating use of Indigenous knowledge in the engineering curriculum

Potential URA Project:

1. Decolonizing and Indigenizing engineering education
2. Student culture, diversity, perspectives, identity, and learning
3. Program evaluation
4. Outcomes-based teaching and assessing
5. Engineering competencies in engineering practice
6. Sociotechnical thinking in engineering
7. Instructor pedagogical practices and belief-systems
8. Epistemologies in engineering education

DR. QIANG ZHANG

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Research Interests: Airborne disease transmission; air quality in animal facilities; airflow through porous media.

DR. WEN ZHONG

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Research Interests: Functional electrospun nanofibers for biomedical applications including wound care and tissue engineering.

DEPARTMENT OF ENTOMOLOGY

DR. KYLE BOBIWASH

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Studies on crop pollination, pollination ecology, northern insect biodiversity, Indigenous agricultural or land development management.

DR. ALEJANDRO COSTAMAGNA

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Research in Dr. Costamagna's lab focuses on processes that regulate insect populations at multiple scales in landscapes with mixed agricultural and natural habitats, with the goal of developing sustainable strategies to maximize healthy food production and promote the conservation of biodiversity. Their projects span a range of topics including ecosystem services at the landscape scale, predator-prey interactions, plant-insect interactions, natural enemy movement across multiple habitats, biological control of invasive pests, host plant resistance, economic thresholds, and sampling methodology.

DEPARTMENT OF ENTOMOLOGY Continued...

DR. JASON GIBBS

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Studies on wild bee diversity, taxonomy and behaviour or beneficial insects in agroecosystems are potential topics.

DR. KATERYN ROCHON

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Dr. Rochon's research program is focused on insects and ticks that affect animal health. In summer 2022, we will be sampling the environment for blacklegged ticks and American dog ticks and we will be looking for ticks on cattle.

DEPARTMENT OF FOOD AND HUMAN NUTRITIONAL SCIENCES

DR. HAROLD AUKEMA

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Summer 2022 research projects in Dr. Aukema's laboratory will examine novel ways of determining the dietary requirement of the omega-3 fatty acid that is obtained from plant sources, alpha-linolenic acid (ALA). The dietary requirement for this essential fatty acid has classically been determined by measuring certain fatty acids. Recently, the technology to analyze the biologically active products of these fatty acids has been developed. Summer projects in our lab will measure these products in samples from rats that were given varying levels of dietary ALA. Measuring these bioactive products will provide a more biologically relevant and accurate determination of the dietary ALA requirement. This will contribute to the knowledge underpinning our dietary recommendations for ALA.

DR. NANDIKA BANDARA

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Dr. Bandara's research group is focused on developing innovative technologies for protein extractions, modifications, and developing value-added applications for proteins such as biodegradable food packaging materials, adhesives, biomedical materials, and nanodelivery systems for drug/bioactive compound delivery. Material science and nanotechnology principles are extensively integrated with traditional food science research areas to achieve these targets.

DR. TRUST BETA

Trust.Beta@umanitoba.ca

Dr. Beta, a Canada Research Chair and Full Professor in the Department of Food and Human Nutritional Sciences has her research program focused primarily on health-promoting phytochemicals in plant-based diets. Investigations include chemical characterization to determine the type of bioactive components in foods, *in vitro* evaluation of their antioxidant and anti-inflammatory properties, and *in vivo* evaluation of

DEPARTMENT OF FOOD AND HUMAN NUTRITIONAL SCIENCES Continued...

their physiological effects using animal models. Grains dominant as staple foods; however, fruits and vegetables are also included in our investigations. Interactions between phytochemicals and carbohydrates or proteins are investigated in establishing optimum functionality in health promotion.

DR. JIM HOUSE

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Dr. House's research focuses on determining the impact of genotype, environment, and processing (examples: extrusion; cooking; protein isolation; deflavouring, fermentation) on the digestibility and amino acid composition of pulses, grains, and oilseed meals. His collaborators have included MPSG, Sask Pulse, Alberta Pulse, Pulse Canada, AGT Foods, & Roquette. Students working in Dr. House's lab will learn skills related to food composition analysis, with a focus on protein, and how these skills can be used to guide industry in new product formulation and marketing. Furthermore, students will interact with collaborators involved in plant breeding, agronomy, and process engineering. These are highly desired skills in demand by industry within the province, including the growing plant protein sector.

DR. CLAUDIA NARVAEZ

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Dr. Narvaez' research interests are in the areas of food microbiology and food safety. We are working towards a better understanding of factors associated with foodborne pathogens (i.e. Shiga Toxigenic *E. coli*, *Salmonella* and *Listeria monocytogenes*) persistence in food processing environments and their resistance to sanitizers. We are also exploring the use of natural antimicrobials such as organic acids, plant extracts and bacteriophages to control foodborne pathogens in the food continuum.

DR. MANEKA MALALGODA

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Dr. Malalgoda's research focuses on grain chemistry and processing quality. With the growing interest in plant-based protein ingredients, currently she is studying oat protein composition through HPLC techniques and protein identification through mass spectrometry. Dr. Malalgoda's team is also working with under-utilized grains and investigating their utilization in novel applications. The goals of the programs include gaining an in-depth understanding of oat protein chemistry and determining versatile applications for different types of grains.

DR. NATALIE RIEDIGER

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Dr. Riediger is interested in working with undergraduate students studying in various disciplines. She has potential research opportunities in two project areas, 1) examining the acceptability of a sugar-sweetened beverage tax among Indigenous populations; and 2) conducting a scoping review of mommy wine culture, or the sociocultural contexts in which mothers consume alcohol.

DEPARTMENT OF PLANT SCIENCE

[DR. BELAY AYELE](#)

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Research Areas: Plant Physiology, Functional Genomics, Molecular Biology and Biotechnology

Research Interests: Plant Hormones/Plant Growth Regulators, Seed Biology, Crop Abiotic Stress Tolerance

[DR. DOUGLAS CATTANI](#)

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The perennial grains program has an assortment of projects ongoing. Projects are multi-year and include agronomic, phenologic and breeding aspects of perennial grain development. In 2022, projects include the impact on seeding date on phenology and reproductive development in intermediate wheatgrass, the response of perennial grain to fall-grazing pressure, phenotyping of perennial grain crosses with respect to reproductive development and output, and nutrient influence on reproductive growth and seed set.

[DR. FOUAD DAAYF](#)

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Research Interests:

- Molecular Mechanisms of Plant-Pathogen Interactions, including mechanisms of plant defense suppression by pathogens.
- Mechanisms of plant disease biocontrol using plant extracts and beneficial microorganisms
- Detection and biology of soil-borne and foliar pathogens

[DR. ROBERT GULDEN](#)

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Dr. Gulden's team's research focus is on crop and weed ecology and management. They run a field and lab program using a broad variety of techniques to answer key questions in these areas.

DEPARTMENT OF SOIL SCIENCE

[DR. INOKA AMARAKOON](#)

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The ability to recycle livestock manure into agricultural soils while keeping soil and water resources clean is vital for the sustainability of livestock cropping systems. The Canadian livestock industry uses approximately one million kilograms of antibiotic active ingredients annually, and antibiotics are readily excreted in manure along with steroidal hormones, growth promotants, and nutrients. Antibiotics in manure-amended soils are susceptible to transport by processes such as spring-thaw snowmelt runoff, rainfall-runoff, and leaching. Antibiotics entering the broader environment pose a risk to ecosystem functioning and human health, particularly by contributing to rising antibiotic resistance, which is one of the most urgent public health emergencies of our time.

DEPARTMENT OF SOIL SCIENCE Continued...

Dr. Amarakoon's research focuses on the contaminant fate in the agroecosystem. Currently, there are opportunities for researching antibiotic sorption, kinetics, thermodynamics, and off-site transport from manure amended croplands. Students can participate in sample collection, conducting laboratory analysis, and data analysis. There are also opportunities for students to lead an independent project of their choice within the listed area of research. Students will gain skills in soil science, environmental chemistry, contaminant transport, analytical chemistry, experimental design, statistical analysis, and organizational, leadership, and teamwork skills. Also, students will be afforded an opportunity to present results at local conferences.

DR. NASEM BADRELDIN

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Dr. Badreldin's research focuses on using artificial intelligence (AI) to monitor, detect, and assess soil and plant conditions at different ecosystems for agriculture and environmental research. This computational-based research aims to transform data into information for better decision-making to support Canada's agriculture sustainability and ecosystem conservation. The undergraduate students will learn new skills in remote sensing data modeling, machine learning, and data programming, which are needed in the current and future job markets in government, industry, and research, and the proposed topics are:

- Mapping land cover dynamics using remote sensing technology (e.g., satellites and drones).
- Estimate physical and chemical landscape properties using synthetic-aperture radar (SAR) satellites.
- Predict above-ground biomass using the integration between light detection and ranging radar (LiDAR) and optical remote sensing.

DR. ANNEMIEKE FARENHORST

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Dr. Farenhorst has a diverse research program and welcomes students from all Faculties. Her natural science research focuses on the fate of pesticides and antimicrobials in soil and water, for example how these chemicals are retained by matrices such as soils, sediments, plants, microplastics and biochars. In 2022, we are particularly welcoming undergraduate students who are interested in better understanding the functionality of on-farm biobeds that are designed to reduce the point-source pollution of water resources by current-use pesticides. In addition, we are seeking undergraduate students who are fluent in Swedish or German and have an interest in social science research. These students have opportunities to participate in an international study that examines the reasons why women either stay in or leave academic and private sector engineering and information technology jobs in Canada, Germany, and Sweden.

DR. XIAOPENG GAO

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Dr. Gao's research focuses on agronomic, environmental and health assessment of soil fertility and nutrient management in agroecosystems, and understanding of nutrient cycling in soil-plant-environment-human systems. His current research projects involve 1) improving cereal grain nutritional quality through new fertilizer products, bioscience techniques and management practices; 2) understanding GHG emissions during spring thaw from croplands; 3) understanding nutrient availability in rhizosphere.

DR. DAVID LOBB

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Dr. Lobb has positions available this coming summer to support two NSERC-funded student projects. The work of these students will be structured to provide opportunities to develop individual research projects. These projects are related to soil erosion and sedimentation. Specifically:

- (i) the assessment of soil erosion using fallout radionuclides,
- (ii) tracking and sourcing sediment using fingerprinting techniques,
- (iii) development of new techniques to restore severely eroded soil, and
- (iv) understanding the role of surface drainage systems in the transfer of water, sediments, and contaminants in agricultural watersheds.

DR. MARIO TENUTA

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Based out of the University of Manitoba and under the leadership of Dr. Mario Tenuta, the [4R Nutrient Stewardship Industrial Research Chair Program](#) and [Applied Soil Ecology Lab](#) has highly productive and impactful [research programs](#) with several important agricultural foci: soil ecology, nematology, nutrient management, and tackling reductions in emissions of the greenhouse gas, nitrous oxide from soil. Our lab is home to many motivated [personnel](#) including undergraduate and graduate students as well as expert technicians. Check us out online and contact [Dr. Tenuta](#).

DR. FRANCIS ZVOMUYA

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Dr. Zvomuya has summer opportunities focussing on:

- (1) the agronomic and environmental aspects of recovered struvite as phosphate fertilizer for crops. Struvite is a form of phosphorus recovered from wastewater, liquid manure, and other waste streams when phosphorus reacts with ammonium and magnesium ions. It has lower solubility than commonly used phosphate fertilizers and may therefore present a lower toxicity risk to seed and seedlings when applied at adequate rates. The project is aimed at testing this hypothesis as well as characterizing the behavior of phosphorus forms when struvite is applied to soils. Students will be involved in collecting soil and plant samples and analyzing these in the laboratory. They will also learn experimental design, data processing and statistical analysis techniques, as well as report preparation and interpretation of experimental results.
- (2) Recovery of oil and gas pipeline right-of-ways (ROWs) on crop land. This research explores the recovery of pipeline ROWs following reclamation. ROWs of different ages ranging from one to 20 years will be examined to determine the progression in soil productivity recovery with time. Measurements will include soil physical, chemical and biological properties, soil health, and crop yields. The research includes field, laboratory, and growth room experimentation. Students will have the opportunity to participate in the latter two and will also learn experimental design, data processing and statistical analysis techniques, as well as report preparation and interpretation of experimental results.