UM | Faculty of Agricultural and Food Sciences

## Undergraduate Research Opportunities in the Faculty of Agricultural and Food Sciences

The Faculty of Agricultural and Food Sciences is committed to the discovery and sharing of knowledge as to how the basic, natural, engineering and social sciences can be applied to serve the needs of Manitoba's agri-food industry.

Many of the Faculty's efforts have helped the agri-food industry meet the challenges of production agriculture. Among the many significant research contributions of the Faculty are the development of canola as a major Canadian oilseed crop, the development of soil testing and classification methodology, farm management systems, grain storage systems, grain transportation policy formulation, mosquito control and the role of bees in crop pollination, value-added product development in the food area, the development of alternative crops and the development of the animal industry in the province.

The Faculty's emerging areas of research strength include agricultural biotechnology, climate change, functional foods and nutraceuticals, international agribusiness, manure and waste management, pesticide free production, precision agriculture and water quality and management.

The FAFS has **over 80 researchers** in the following departments and research centres:

**Departments**
Agribusiness and Agricultural Economics
Animal Science
Biosystems Engineering
Entomology
Food and Human Nutritional Sciences
Plant Science
Soil Science

**Centres**
Bruce D. Campbell Farm & Food Discovery Centre
National Centre for Livestock and the Environment
Richardson Centre for Functional Foods & Nutraceuticals
Canadian Wheat Board Centre for Grain Storage Research

### *Many of them would be happy to host you in their lab this summer*

Please check out their research profiles

*Including:*

**Dr. Derek Brewin** – **Professor, Agribusiness and Agricultural Economics** – Derek.Brewin@umanitoba.ca

Derek Brewin is a Professor and Head of the Department of Agribusiness and Agricultural Economics. He has a Ph.D. from Penn State University in Agricultural, Environmental and Regional Economics. His most recent research has focused the economics of crop rotations, grain transportation by rail, and the canola trade case.

**Dr. Karmin O** – **Professor, Department of Animal Science** – karmino@sbrc.ca

**Potential URA project – 2020**
We are 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. Our 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.
Current research projects:

- 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. Argenis Rodas-Gonzalez – Assistant Professor, Animal Science –** Argenis.RodasGonzalez@umanitoba.ca

As a meat scientist, my research goal is to study ante- and post-mortem factors that can improve carcass and meat quality characteristics and value. My current research program is focused on the following areas: a) animal management to improve animal performance and carcass outcomes; b) test the ability of new technologies to segregate carcass and meat in different yield and quality levels; c) application of novel packaging systems, natural compounds and antimicrobial coatings to improve meat shelf life and food safety. One of the main projects of my program is studies to minimize the darkening of bison meat and delay the tendency towards early browning during retail display through a comprehensive understanding of the oxidation/reduction mechanisms of bison myoglobin in different muscles during storage and retail display under differing packaging systems; resulting in objective and subjective colour changes. The knowledge acquired in these kinds of studies can be applied by producers, processors, purveyors and retailers of the meat industry to expand fresh meat sales, offering a more consistent, acceptable, safe and desirable product to consumers.

**Dr. Chyngyz Erkinbaev, Assistant Professor, Biosystems Engineering** – Chyngyz.Erkinbaev@umanitoba.ca

Chyngyz's research focuses on smart sensing technologies for monitoring food quality and safety with an emphasis on development of computational tools. He believes that smart technologies are aiming to make agri-food systems more productive, efficient, and sustainable. His current research includes the development of a multimodal approach for non-destructive and accurate quality assessment of various food matrices during the processing.

**Potential URA projects:**

1. Development of smart sensing module for accurate real-time prediction of the shelf-life of the ready-to-eat food.
2. Development and optimization of a multispectral smart sensing system for chemical mapping of biomaterial.
3. 3D multiscale modeling of food microstructure.

**Dr. (Ranjan) R. Sri Ranjan – Professor, Department of Biosystems Engineering –** Sri.Ranjan@umanitoba.ca

Undergraduate research award opportunities available in the areas of irrigation, drainage, on-farm water management, soil and water remediation, nutrient management, computer modelling of water and chemical movement in soils.

**Dr. Alejandro Costamagna** – **Associate Professor, Entomology** – Ale.Costamagna@umanitoba.ca

Ale's research focuses on insect ecology at multiple spatial scales in human-dominated landscapes, with emphasis in ecosystem services, sustainable management of agricultural pests, and biological control. Current research projects include studying impacts of natural enemies on soybean aphids, fitness of different morphs of soybean aphid, effects of landscape structure on parasitism and predation of cereal leaf beetle, and mechanisms of plant resistance to wheat midge.

**Dr. Jason Gibbs** – **Assistant Professor, Entomology** – Jason.Gibbs@umanitoba.ca

The Gibbs lab conducts research in many aspects of wild bee diversity, including, but not limited to, landscape ecology, alpha-taxonomy, molecular phylogenetics, plant-pollinator associations, and social evolution. There are undergraduate research opportunities in field, lab, and museum-based studies.

**Dr. Mohammed Moghadasian – Professor, Food and Human Nutritional Sciences** – mmoghadasian@sbrc.ca

Mohammed's research interest includes investigation of the roles of dietary agents in lipoprotein metabolism and the pathogenisis and/or prevention of metabolic abnormalities including atherosclerotic vascular disease, and related cardiovascular complications of obesity and diabetes, using well established animal models. Mohammed's research goal is to provide scientific evidence for development of new functional foods and nutraceuticals for prevention of cardiovascular diseases.

**Dr. Paul Bullock – Professor, Soil Science** – Paul.Bullock@umanitoba.ca

Developing a Fusarium Head Blight Risk Model to Improve Cereal Production in Western Canada

Our research team is currently investigating a significant disease known as Fusarium Head Blight (FHB) in cereal crops of Western Canada. This disease is particularly severe because it can produce mycotoxins that render the grain unusable for human or animal consumption. The goal of the project is to develop a method to utilize weather information for assessing the risk of FHB in Western Canadian cereal crops, specifically spring wheat, winter wheat, barley and durum. Weather data and FHB incidence data is being collected across the prairies and will be used to develop weather-based models that reflect the particular climatic conditions, *Fusarium* species and chemotypes of the region. The project requires collaboration between researchers, students, plot site managers, producers and provincial government staff in order to compile a robust and comprehensive dataset capable of delivering the desired outcome. We invite interested undergraduate students to join the project team during the summer. Students will take part in field data collection, learn how to assess cereal crop development stage and FHB incidence in producers' fields as well as meet with the producers to gather information about the management of the crops. It is an opportunity to travel around Western Canada and become familiar with the agricultural regions of the prairies.

Assessment of Canopy Reflectance Tools for Crop Nutrient Management

For the past four years, our research team has been assessing several reflectance measurement instruments and assessing their ability for early detection of nitrogen deficiency in crops, including wheat, corn and canola. With high clearance sprayers now common or available on many farms in Manitoba, crop producers have the opportunity to apply liquid N midway through the growing season, when yield potential is more predictable and when risk of early season losses due to excess moisture have diminished. However, there is also risk of midseason N applications being ineffective if applied too late for the crop to benefit. Canopy reflectance is a potential means for assessing crop nitrogen status early in the growing season to determine if additional mid-season nitrogen fertilizer will be beneficial and with sufficient time for the application to be effective, if needed. We invite students to join the research team during the summer period. Students will learn how to operate all

of the reflectance instruments including a Red Edge 3 multispectral camera mounted on a drone. If students can pass the Basic Drone Pilot exam, they can learn to fly the drone and collect reflectance data with it. Students will also learn how to handle the data collected from the instruments and rudimentary data processing and analysis.

**Dr. Annemieke Farenhorst** – **Associate Dean (Research), Professor, Soil Science** – agresear@umanitoba.ca

Dr. Annemieke Farenhorst is a Professor of Soil Science and her team of students are involved in a range of fundamental and applied studies related to soil and water quality, and socio-economic, environmental health. In 2020, 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 pesticides. Opportunities for students include participating in field research to collect samples, and conducting laboratory analysis on samples – as well as leading an independent project. Dr. Farenhorst has also an interest in supporting undergraduate students who want to conduct transdisciplinary research such as merging social science and natural science research, for example in topics such as drinking water distributions systems as they relate to First Nation reserves, or advancing the increased participation of women in natural sciences and engineering fields from a broad perspective including data analytics (e.g., advancing decoders used in job advertisements and resume screening).

**Dr. David Lobb, Professor, Soil Science** – David.Lobb@umanitoba.ca

Dr. Lobb has positions available this coming summer to support three NSERC-funded projects. The students' research activities will be structured to provide opportunities to develop individual research projects for the students. 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, and
(iii) development of new techniques to restore severely eroded soil.

**Dr. Mario Tenuta, Professor, Soil Science** – Mario.Tenuta@umanitoba.ca

Students have the opportunity to work on various soil ecology projects, including those on the mitigation of greenhouse gas emissions from agriculture, (e.g., limiting spring-thaw emissions of nitrous oxide, optimization of manure application to reduce greenhouse gas emissions), the 4R nutrient stewardship; arbuscular mycorrhizal fungal ecology; and nematology.

**Dr. Francis Zvomuya – Professor, Soil Science –** Francis.Zvomuya@umanitoba.ca

The research focuses on 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.