AGRICULTURAL SYSTEMS FOR A HEALTHY PLANET

2020 – 21 IMPACT REPORT

UNIVERSITY of GUELPH

FOOD FROM THOUGHT

STATEMENT OF LAND ACKNOWLEDGMENT

We acknowledge that the University of Guelph resides on the treaty lands and territory of the Mississaugas of the Credit, and we recognize and respect our Anishinaabe, Haudenosaunee and Métis neighbours. The work presented in this annual impact report has occurred on lands with rich Indigenous connections, and we aim to build lasting partnerships that respect, honour and value the Indigenous cultures, traditions and wisdom of those who have lived before us, those who are here and those who have yet to come. In particular, the Dish with One Spoon Covenant, an important pre-colonial agreement between Nations that then lived across much of what is now southern Ontario into Quebec and the state of New York, reminds us that we must inhabit the land and use its resources (the dish) wisely, as we use the one spoon to share the bounty among us all.

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MESSAGE FROM THE VICE-PRESIDENT (RESEARCH)

BRIDGING THE DISTANCE

We are proud to share with you the 2020-21 Food from Thought annual impact report.

This report highlights the incremental achievements of Food from Thought in 2020-21, arguably one of the most disruptive years of our time. Our thoughts are with those who have suffered incredible personal losses due to the global health crisis and its impacts.

In a year when many challenges conspired to divide us, our community of University of Guelph researchers has come together. We've embraced new tools to work remotely, and we've transformed research labs to respond to emerging threats. For example, Food from Thought food safety researcher Dr. Lawrence Goodridge was able to work quickly with new partners to monitor wastewater for SARS-CoV-2, providing another tool to predict and manage the outbreaks of COVID-19.

Despite our successes in maintaining continuity in our research programs and in connecting online, the divide has left us longing for closer connections that go beyond Zoom. In this year's annual report, we're bringing you stories about the complex problems that researchers are working to address and about how Food from Thought is transforming the ways we produce our food.

We hope you enjoy this deeper dive into some of the leading-edge research within Food from Thought. ■

Malcolm Campbell
Vice-President (Research)

MESSAGE FROM SCIENTIFIC DIRECTOR

PIVOT!

Along with all the uncertainty and complexity of maintaining momentum during the pandemic, 2020 also marked the midpoint of the Food from Thought research program. These events provided an opportunity to take stock and reflect on how far we've come – and what we need to bolster – as we continue this journey toward solutions and agricultural systems for a healthy planet.

We are very proud of our researchers, especially our graduate students, who are building up a formidable foundation of fundamental and applied insights. Your work will help humanity reach the twin goals of meeting our demand for food without undermining the ecosystems on which we all depend.

Looking ahead, we are excited to focus on some key priorities that will build on these successes. First, we are committed to developing a more comprehensive data strategy. Data – and access to data – is the lifeblood of the digital revolution, and a data strategy is central to applying digital tools to food and farming. Second, the next phase of the Food from Thought program will be guided by the need for better scientific integration. The world's big problems will not be solved by disciplinary scientists working in academic silos, and the goals of Food from Thought will be met only with cross-disciplinary collaboration. Third, we are committed to ensuring that the academic work funded by Food from Thought is mobilized to support decision-makers, whether on farms, in boardrooms or in the halls of Parliament.

It has been a rich and rewarding three years, and we are all looking forward to more! ■

Evan Fraser
Scientific Director

OVERVIEW

AGRICULTURAL SYSTEMS FOR A HEALTHY PLANET

Food from Thought is tackling the challenge of how to feed a growing global population by advancing our understanding of the complex interplay between farming practices and the environment

The program's goal is to increase the sustainability and productivity of global food production by leveraging the power of big data, agri-food and biodiversity science.

Food from Thought is positioning Canada as a global leader to create agricultural systems for a healthy planet on global, landscape and micro scales through four key strategies: cutting-edge research; training of the next generation of agri-food leaders; innovation, commercialization and knowledge mobilization; and increasing the University of Guelph's capacity for data science expertise through faculty recruitment and by catalyzing the development of an integrated data-sharing and analytics platform.

Food from Thought: Agricultural Systems for a Healthy Planet is a research program led by the University of Guelph, funded in part by a $76.6-million grant from the Canada First Research Excellence Fund.

OUR VISION

Our vision is to transform our understanding of the ecosystems we depend on for food, at scales that range from planetary to microcosmic. The goal is to increase the capacity, sustainability and safety of food production systems without undermining environmental health, ecosystem services or livestock health and welfare.

Food from Thought will create and implement next-generation information management systems, decision support tools and digital applications that intelligently collect, analyze and apply massive amounts of data from crops, livestock and the environment. This new digital agricultural research platform will provide solutions to identify food fraud, reduce food safety risks, refine pesticide and fertilizer use, monitor soil and crop health, control pathogens and track emerging infectious disease threats.

OUR MISSION

NEW RESEARCH DOLLARS AWARDED

$1,200,000 Digital Agriculture Research Fund II

RESEARCH DOLLARS DISTRIBUTED

$2,500,000 Biodiversity

$1,273,536 Digital Agriculture Research Fund

$372,000 Partner Universities

$2,398,204 Thematic Research Fund

$6,543,740 Total Distributed

OUR IMPACT IN NUMBERS

115 Participating Faculty

43 Students with HQP Scholarships

18 Policy Fellowships Awarded

42 Partners

249 Collaborators

55 Knowledge Users

311 Outreach Events and Workshops

180 Media Interviews with FfT Investigators

29k Google Scholar Citations

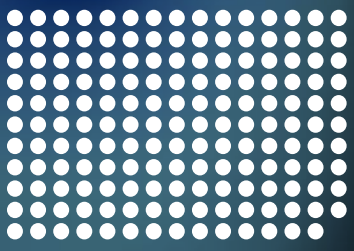
1,669k Website Hits for Core Team

750k YouTube Views for Core Team

80 Team Members Tweeting Regularly

NUMBER OF PARTICIPANTS

70 Undergraduate Students



164 Master's Students

98 Doctoral Students

34 Post-doctoral Researchers

28 Research Associates

47 Technicians

EQUITY, DIVERSITY AND INCLUSION

Fostering a culture of inclusion is an institutional imperative at the University of Guelph. We strive to ensure that every member of our diverse population feels a sense of belonging as a valued contributor to our campus community.

Fostering a culture of inclusion is a shared responsibility and strong leadership and governance are essential to achieve meaningful outcomes. The newly formed Equity, Diversity and Inclusion (EDI) in Research Advisory Committee is vital to the work of the Food from Thought (FfT) research program. It aims to empower faculty to apply an EDI lens across the research enterprise, build equitable and inclusive research teams, and formally establish pathways to advancement for researchers. The committee also advises the vice-president (research) on strategies to address systemic barriers in the research enterprise.

Guided by the Food from Thought EDI Action Plan, the work of the EDI in Research Advisory Committee, and the services provided by the Office of Diversity and Human Rights, FfT researchers work to ensure that they embed principles of equity, diversity and inclusion in their research. They implement EDI measures that inform their data collection, recruitment practices, and ongoing monitoring and course correction of research projects. In doing so, they are producing stronger research that more accurately reflects and serves society.

EDI LEARNING ACTIVITIES:

- FfT research teams take the Principles of Belonging training module offered by the Office of Diversity and Human Rights
- Core staff, principal investigators and the FfT leadership team are required to participate in a 90-minute online module called Inclusive Leadership: Applying Anti-Oppressive and Anti-Racism Lenses to Decision-Making
- A new working group is being formed to review FfT's EDI Action Plan and advise the FfT Steering Committee on strategies to foster EDI culture within FfT, working with the EDI in Research Advisory Committee
- FfT staff participate in the Government of Canada's Gender-Based Analysis Plus (GBA+) training course
- Peer reviewers are required to complete the Government of Canada's Bias in Peer Review online training module

Confronting and undoing how racism, discrimination and oppression have shaped the culture of our institutions is necessary and challenging work that requires honesty and vulnerability. We are in many ways just at the beginning of this journey toward decolonizing research. To this end, we declare our commitment to learning, growing and doing better, together. ■

CORE FACULTY

Food from Thought is advancing interdisciplinary agriculture and food research at the University of Guelph across colleges including the College of Biological Science, College of Engineering and Physical Sciences, College of Social and Applied Human Sciences, Ontario Agricultural College and Ontario Veterinary College.

The interdisciplinary approach of Food from Thought research is creating real-world impact through strategic collaboration among leading experts at U of G, in Canada and internationally. Food from Thought is providing graduate, post-doctoral and researcher funding opportunities, resulting in cutting-edge research that will position Canada as a global leader in the development of innovative solutions that will solve problems in the wider agri-food system and feed our growing planet.

CORE FACULTY

Madhur Anand
School of
Environmental Sciences

Christine Baes
Department of
Animal Biosciences

Rowan Barrett
Department of Biology,
McGill University

Grégoy Bédécarrats
Department of
Animal Biosciences

Aaron Berg
Department of
Geography, Environment
and Geomatics

Renée Bergeron
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Nicholas Bernier
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Integrative Biology

Asim Biswas
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Dominique Bureau
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McGill University

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Rozita Dara
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William Deen
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Plant Agriculture

Ali Dehghantanha
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Environmental Sciences

Ming Fan
Department of
Animal Biosciences

Jeff Farber
Department of
Food Science

Vahab Farzan
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Evan Fraser
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Geography, Environment
and Geomatics

Robert Friendship
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Paul Hebert
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Andrew Hendry
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McGill University

Hugh Henry
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Western University

Andreas Heyland
Department of
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Dave Hooker
Department of Plant
Agriculture (Ridgetown)

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Department of Animal
Biosciences

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Department of
Integrative Biology

Shoshanah Jacobs
Department of
Integrative Biology

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Department of Biology,
University of Victoria

Niel Karrow
Department of Animal
Biosciences

Krishna KC
Department of
Geography, Environment
and Geomatics

David Kelton
Department of
Population Medicine

Elijah Kiarie
Department of Animal
Biosciences

Fred Laberge
Department of
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Department of
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Department of Molecular
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Integrative Biology

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Department of
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Department of
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Filippo Miglior
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Statistics

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Peter Pauls
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Ratnasingham**
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Charlotte Winder
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Population Medicine

Katherine Wood
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Animal Biosciences

Evgeny Zakharov
Department of
Integrative Biology

Tyler Zemlak
Gordon S. Lang School of
Business and Economics

FOOD FROM THOUGHT IN THE MEDIA

Grégoy Bédécarrats
Match from hatch
Canadian Poultry Mag

Trevor DeVries
Robots don't just help farmers' mental health. Cows like them, too
Times Colonist

Researchers link dairy-farmer quality of life to automation and technology
The Globe and Mail

Consistent feed crucial in dry cows
The Western Producer

Kari Dunfield
Lasting impact, technology helps living soils knowledge
Farmtario

Managing the soil microbiota
TopCrop Manager

Research ramps up on soil biodiversity and health
TopCrop Manager

Peter Pauls
Mix and match
TopCrop Manager

Nigel Raine
Insecticide decimates popular pollinator, the squash bee, Ontario research suggests
Toronto Star

Neonic soil treatment hurts ground-nesting bees, 1st of its kind study finds
CBC

Researchers record first-ever Canadian sighting of bee species in Windsor park
CBC

Claudia Wagner-Riddle
Cover crops reduce nitrate leaching
Farmtario

Reducing N losses in corn systems
TopCrop Manager

Tina Widowski
Giving pullets room to thrive
Canadian Poultry Mag

Slow-growing chickens more mobile
The Counter

Poultry industry reacts to landmark welfare report
Watt Poultry

Are today's broiler chickens too inactive?
Global Animal Partnership

GAP announces completion of UoG research
Global Animal Partnership

See the online annual report at www.foodfromthought.ca for direct links to these media articles

OUR STORIES

FOOD FROM THOUGHT RESEARCH MAKING AN IMPACT

Every project tells a story. Read the following research stories written by Lois Harris to learn about how Food from Thought-funded research projects at the University of Guelph are leading to innovations and improved agri-food practices and, ultimately, creating agricultural systems for a healthy planet.

HELPING FARMERS PROTECT THE ENVIRONMENT

University of Guelph researchers are working directly with farmers to quantify how their ecologically beneficial practices can protect the environment and fight climate change without adversely affecting – and sometimes while boosting – their bottom lines. “There is a range of solutions including carbon sequestration, improving biodiversity and retaining nutrients on the land,” says Dr. Andrew MacDougall, a professor in the University of Guelph’s Department of Integrative Biology.

Andrew MacDougall
Department of
Integrative Biology

The ALUS effect

With funding from the Food from Thought program, MacDougall and his team have been working with ALUS (named for the alternative land use services pilot project that launched it) to provide scientific proof of how beneficial practices positively affect the environment on 22 farms across Southwestern Ontario.

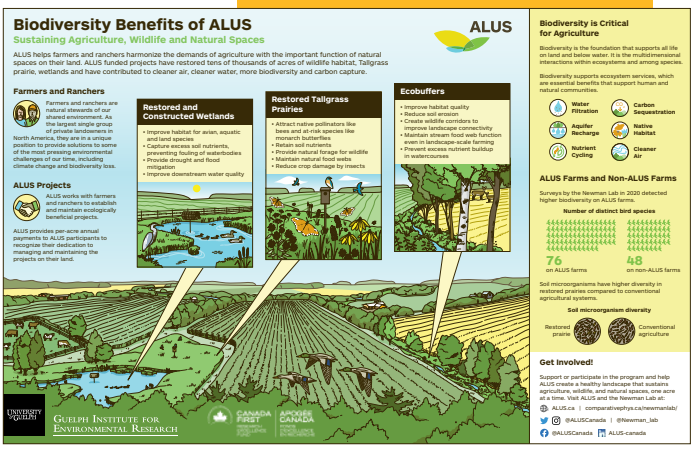
ALUS is a non-profit organization that helps farmers and ranchers with technical assistance and financial payments to provide ecosystem services such as clean air and water, flood mitigation, erosion control and wildlife habitat. Its New Acre™ project helps companies like Danone, Cargill, TD Bank and A&W Canada meet their environmental sustainability goals by investing in project acres for which farmers and ranchers receive compensation for maintaining natural areas on their land.

As one example of how his research is used, MacDougall says he and his team worked with ALUS and Danone to estimate how much carbon was being sequestered through its 90-acre investment.

ALUS initially contacted MacDougall in 2013 to measure the environmental services that would be provided by retiring marginal farmlands and instead implementing nature-based solutions that promote biodiversity and crop resilience. They started with pollinators but have moved into understanding how these lands better retain nutrients like phosphorus and nitrogen, as well as conducting wetland research and wildlife habitat studies.

“ALUS provides payments to farmers to offset the costs of taking the land out of production that approaches break-even,” he says. “That marginal land is also the most expensive on which to grow crops because it’s not as productive, so farmers can direct those savings into making the good land better while also providing society with a range of environmental benefits from their ALUS projects.”

Download this infographic which illustrates how restoration services on ALUS farms contribute to cleaner air, cleaner water, more biodiversity and carbon capture



Learn more about Aleksandra's research and watch as she collects field samples in this video

vimeo

Student scientists help

Among the researchers studying in the field is University of Guelph graduate student Aleksandra Dolezal, who has been working with ALUS for the past three years. She is a Highly Qualified Personnel scholar under a a program that supports the development of highly skilled graduates to bring leadership to the agriculture and food sector. The program is funded by Food from Thought and the Ontario Agri-Food Innovation Alliance, a partnership between the University of Guelph and the Ontario Ministry of Agriculture, Food and Rural Affairs.

Dolezal recently published her master's thesis called "Restored marginal farmland benefits arthropod diversity at multiple scales."

"Taking marginal lands out of production is one of the best things farmers can do – there are areas where the soil fertility is poor and where the tractors can't get around the edges of the field, so it's easy just to leave it alone and plant it with prairie grasses which are drought-resistant," she says, adding that these grasses can also be mown and fed to livestock.

Dolezal investigated insects in the population that lives in the naturalized land. "What we've found is that while you do get herbivorous species, you don't get the pests that adversely affect crops," she says. The land attracts mostly pollinators looking for food.

She says that on the farms she has studied, an average of almost 10 per cent of the land has been taken out of production – some have done more and some have done less, depending on the individual farmer.

"It didn't matter how old the prairie was or what size it was, in every case it produced beneficial insects within the first planting year," she says.

Dolezal says working directly with the farmers was an enjoyable experience.

"They still contact me and send me pictures of bugs and ask me to identify them," she says. They're curious and they love research, so I sent them the lab reports as soon as we got them."

By providing solid research and data for both large companies and individual farmers, MacDougall's team is moving the yardsticks on protecting both the environment and farmers' incomes. ■

DIGGING DEEP TO FIND OUT WHAT'S HAPPENING IN THE SOIL

The need to find more sustainable ways to produce food is urgent, with a world population predicted to reach nine billion by 2040 and ample proof of the adverse environmental effects of intensive agriculture.

Kari Dunfield
School of Environmental Sciences

With funding from Food from Thought, Dr. Kari Dunfield and her team are helping find ways of farming that can both meet global food requirements and protect the planet.

"If farmers want to have sustainable agriculture, fight climate change and sequester carbon, they should be minimizing the chemical inputs," she says. "If they want to do that, they want to promote the microbiome."

Using biologicals

In response to the demand for more ecologically friendly options, Dunfield says, that companies – even chemical companies – have been looking to add biological pesticides and fertilizers to their repertoire to reduce their carbon footprint.

"Using soil microbes as inoculants to encourage plant growth has been practised for thousands of years, but on a commercial level there's only a handful of organisms that have been successful," says Dunfield, who is a professor in the University of Guelph's School of Environmental Sciences and the Canada Research Chair in the Environmental Microbiology of Agro-ecosystems.

Dunfield says current biologicals lack consistent results, costing farmers money for the products and for potential crop failure.

"We need to think about getting consistent results that farmers trust," she says.

Dunfield and her team published a paper showing that soil science – along with microbiology and plant biology – has to be taken into account because of the complexities of the environment in which micro-organisms live.

Summer students Sarah Fox and Olivia Blumenthal

Called "It takes three to tango - the importance of microbes, host plant, and soil management to elucidate manipulation strategies for the plant microbiome," the paper was published in the *Canadian Journal of Microbiology* in May 2020.

The importance of field research

Dunfield explains that researchers usually study microbes in a lab or greenhouse where many factors may affect their usefulness.

"We thought about it from two different perspectives – adding an inoculant into the system, but also exploring what kinds of practices a farmer could use to increase the native population of microbes that are already really good at promoting plant growth and controlling pathogens in the field," she says.

"The systems are very complex, and you can't expect to find one microbe that works in all field situations. The options were either selecting a plant that helps the micro-organisms live, introducing a group or consortium of micro-organisms that might work or encouraging the beneficial micro-organisms that are already in the soil."

Dunfield says her team is looking at micro-organisms in systems that benefit plant growth either as bio-fertilizers or bio-controls for plant pathogens. Instead of seeking individual organisms, they're examining functional groups such as nitrogen- or phosphorus-cycling organisms.

Marcus Johnson, M.Sc. student, preserves soils in a field trailer for RNA extractions in the lab

Collaborative effort

The team is also looking at long-term research trials in crop rotation, reduced tillage and cover crops at the University of Guelph's Ridgetown Campus.

"We know that they're getting yield benefits out of some of these best management practices, so we're using genomics to really understand what those microbial communities look like and how they interact," says Dunfield, referring to a long-term cover crop trial being conducted by Dr. Laura Van Eerd, a professor in the School of Environmental Sciences.

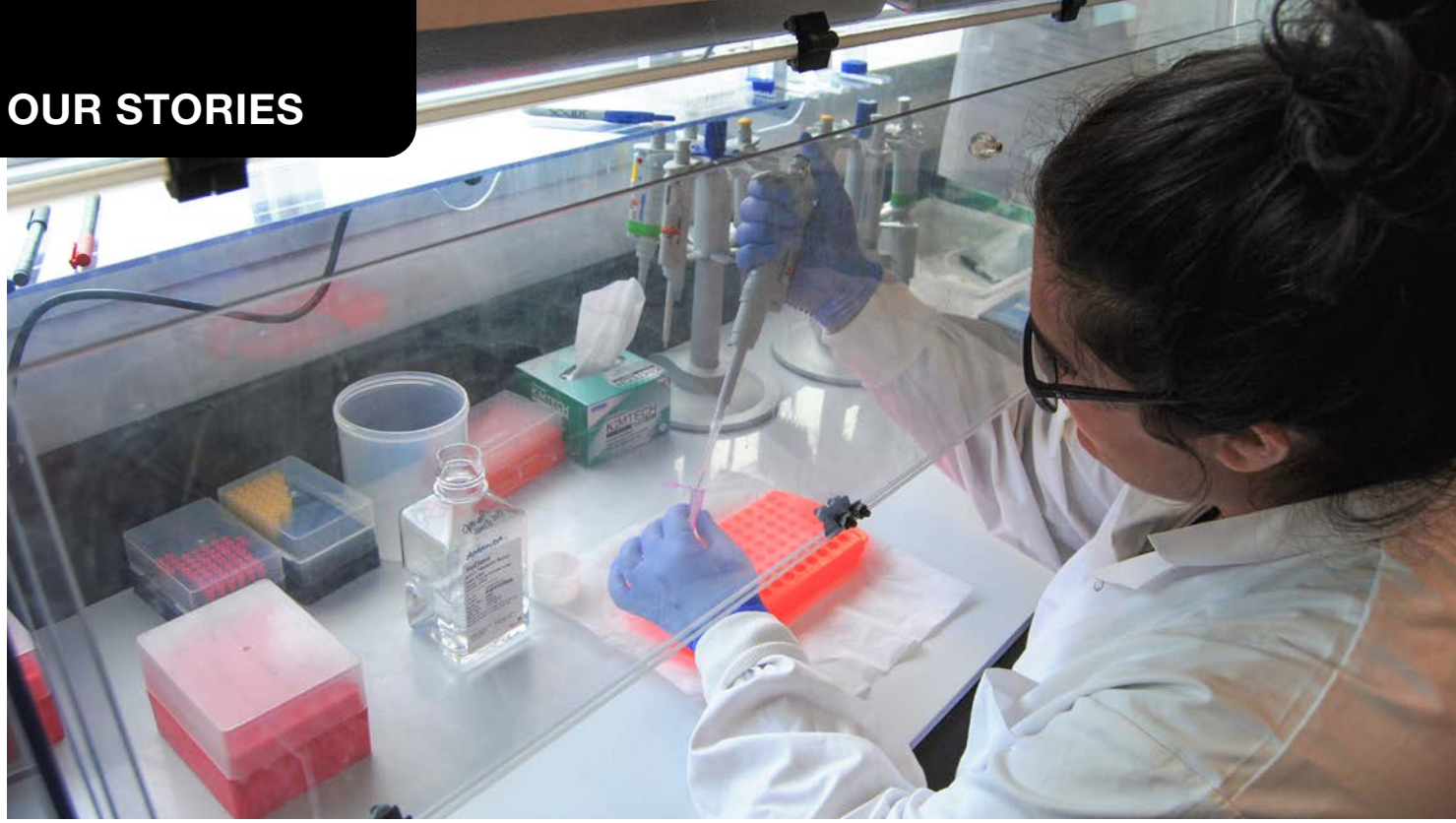
"That trial has shown improved yields related to nitrogen for various cash crops, although the researchers need to learn more," Dunfield says.

In 2015, Dunfield's team explored soil microbial communities in the Ridgetown research trials following a tomato crop. At that time it was after a tomato crop. They returned in 2020 after the planting of a corn crop with a new set of bioinformatic tools, and identified microbes that were associated with different cover crops.

"We know that the cover crops are influencing which micro-organisms are there," she says. "We're starting to link changes in the microbial communities with changes in plant biomass and pathogens in the field."

Working with the researchers who are conducting long-term trials has been helpful for Dr. Dunfield's work because those researchers are extremely knowledgeable and have gathered data under a variety of field conditions.

Her ultimate goal is to help find environmentally sustainable farming practices that promote healthy soil and consistently produce higher crop yields in all climate conditions. ■



NEW TECHNIQUE PINPOINTS WHERE FOOD COMES FROM

Spatial fingerprinting, a new method for detecting where food items originate, could help the global food system become more transparent and sustainable.

"We're using multiple bio-tracers that have a geographical signal or fingerprint to find out where a species is from," says Dr. Kevin McCann, a professor in the Department of Integrative Biology. "When a fish lives in a certain area, for example, through the water and through consumption it starts to wear that area's spatial fingerprint."

He explains that looking for many bio-tracers like DNA, stable isotopes, fatty acids and even the colour of the reflection of a fish provides robust data for finding the provenance of the species. There are thousands of potential bio-tracers in every species.

McCann worked with Dr. Robert Hanner, professor in the Department of Integrative Biology and Arrell Food Fellow, together with research associate Kevin Cazelles and several others on the project, which was funded by Food from Thought.

It's the kind of transformative research that directly supports part of Food from Thought's mission, which is to increase the capacity, sustainability and safety of food production systems without undermining environmental health, ecosystem services or livestock health and welfare.

Robert Hanner
Department of Integrative Biology

Kevin McCann
Department of Integrative Biology

Increasing traceability precision

Global food supply chains are notoriously complex, with many steps along the chain from where the raw product starts to when it arrives at the grocery store or restaurant. If managed improperly, the potential for mislabelling where the food came from or even what it is – either inadvertently or intentionally – is very high.

Food fraud is economically motivated and takes a variety of forms, including ingredient substitution and other kinds of misrepresentation. It has a variety of consequences for consumers, producers and the environment. For example, seafood fraud not only compromises an industry that globally generates $143 billion annually, but it also creates food safety risks, compromises the ocean's ecosystem, depletes important fish stocks and cheats honest people in the fishing industry.

In an earlier study conducted with the Canadian Food Inspection Agency, Hanner found that nearly 20 per cent of the samples being imported into Canada were mislabelled. At the wholesale and processor level, it was closer to 30 per cent, and at retail closer to 40 per cent.

Some countries have stricter regulations for sustainable fishing than others, so providing accurate information on the provenance of seafood and other food items increases the industry's transparency and allows consumers to choose how they want to spend their money.

Research methodology

The team published a paper called "Spatial fingerprinting: horizontal fusion of multi-dimensional bio-tracers as solution to global food provenance problems" that details how the researchers approached the project and its results.

The paper explains how multiple bio-tracers are used to create a spatial fingerprint and how using more bio-tracers makes results more accurate.

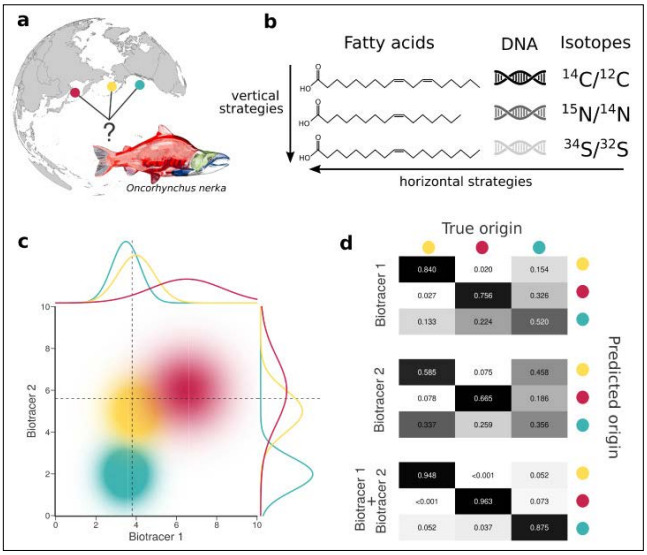
Data fusion of bio-tracers is a powerful technique for determining a species' provenance. Data fusion takes hundreds or thousands of pieces of information and puts them together for authentication, for example, in facial recognition technology.

In this study, 90 sockeye salmon samples were identified from three different zones: the U.S. (Alaska), Canada and Russia.

By examining 17 bio-tracers – fatty acids and stable isotopes being the strongest indicators – the researchers demonstrated that increasing the number of bio-tracers increases the accuracy of regional traceability.

"We found that the higher the number of bio-tracers, the better the resolution and the more accurate the results," says research associate Kevin Cazelles. "I was surprised that with a relatively small number of bio-tracers, we could be so accurate."

The team used three supervised learning methods to reflect current and emerging trends in food



Combining bio-tracers helps improve the determination of sockeye provenance

authentication. Supervised learning is a subset of machine learning and artificial intelligence that offers a powerful tool in classifying and processing data.

The new approach could be applied to a number of other species and has tremendous potential for tracing where food originates globally.

"You could even use this method to trace terrestrial food products like palm oil," McCann says, cautioning that more work needs to be done.

“We’re using multiple bio-tracers that have a geographical signal or fingerprint to find out where a species is from.”

Dr. Kevin McCann

The future of spatial fingerprinting

While the proof of concept has shown that the method will likely work, it’s early days. McCann says that, with additional funding, the next step would be to build a library of data on fish and other species.

“This is huge boon to the industry,” says Hanner, who has been researching food fraud for years.

“For places like Canada, where the regulations are tight because of the lessons learned around overharvesting cod, consumers can be fairly confident in buying fish from here,” he says, adding that other countries don’t necessarily have the same rules. The Canadian cod fishery was closed in the early 1990s due to decades of overfishing that triggered a massive decline in the cod population. Tens of thousands of jobs were lost almost overnight.

In an interesting twist, a journalist with *National Geographic* contacted the researchers and asked them to test sockeye salmon that she had purchased at markets in New York City.

“Some of the salmon that was labelled as product of the U.S.A. were actually Russian,” Hanner says. “Dr. McCann and his team’s work in bringing a whole constellation of markers to bear, along with the mathematical modelling and analysis, to provide this discriminatory power, is really path-breaking.” ■

SLOWING DOWN CHICKEN GROWTH

A wide-ranging, comprehensive research project investigating how different growth rates affect chickens' health and welfare may change the poultry industry with a shift to slower-growing birds in the future.

Tina Widowski
Department of Animal Biosciences

"Fast-growing broilers have been highly selected over the past 50 years to efficiently turn chicken feed into meat," says Dr. Tina Widowski, a professor in the University of Guelph's Department of Animal Biosciences, holder of the Egg Farmers of Canada Research Chair in Poultry Welfare and a researcher with Food from Thought.

"They've also been selected for large breast muscles because of consumer demand."

Animal welfare issues

Widowski says that while the result has been an inexpensive, highly efficient, environmentally friendly animal protein product, high rates of growth coupled with large breast sizes have had a lot of adverse consequences for the birds.

Through selective breeding, the birds' body composition, appetite and metabolism have changed so that they grow really fast – from chick to slaughter in about five to six weeks in a commercial operation.

The growth of muscle meat outpaces the skeleton and heart, so the chickens have trouble with mobility and lameness, and are much less active.

"There are biological limits, and speeding up growth rates produces adverse consequences to the chickens' health and physiology," she says, pointing out that these problems have existed for decades.

Consumer concerns about the animal welfare issues prompted poultry producers and retailers in the Netherlands to develop the Dutch Retail Broiler, also known as the "Chicken of Tomorrow." This slower-growing breed is allowed to gain only up to 50 grams per day, is stocked at a density of up to 38 kilograms per square metre and is provided with environmental enrichment.

In North America, Global Animal Partnership (GAP), a U.S. animal welfare standards organization founded by Whole Foods Market CEO John Mackey, approached University of Guelph researchers to conduct this project.

The University's Food from Thought program, the Ontario Agri-food Innovation Alliance – a partnership between the University and the Ontario Ministry of Agriculture, Food and Rural Affairs – and several major poultry genetics companies provided support for the project.

Food from Thought aims to position Canada as a global leader in the development of innovative solutions that improve both the sustainability and the productivity of agricultural production at global, landscape and micro scales.

The research

The project was an interdisciplinary effort that examined everything from animal welfare and behaviour to feed efficiency, meat quality, anatomy and mobility. Working with Widowski, research associate Stephanie Torrey managed a large team of post-doctoral students, technicians, graduates and undergraduates, in collaboration with faculty from across the Ontario Agricultural College and the Ontario Veterinary College.

A total of 7,528 broilers from 14 different genetic strains were examined over two years. They consisted of 12 slow-growing strains and two conventional strains that were categorized into conventional, fast slow-growing birds, moderate slow-growing birds and slow slow-growing birds. All of them were incubated, hatched, housed, managed and fed in the same way, and the categories of strains differed in body weights, growth rates, feed intake and feed efficiency. At 48 days of age, for example, strains in the conventional category were 835 to 1,264 grams heavier than strains in the other categories.

An article prepared by the research team and published by GAP in fall 2020 said:

"In summary, we found that conventional strains of broiler chickens grew faster, more efficiently and had higher breast yields than did slower growing strains. However, there are significant trade-offs for this high productivity. In comparison to strains with slower growth rates and lighter breast yields, strains with faster growth rates and higher breast yields had lower activity levels, poorer indicators of mobility, poorer foot and hock health, higher biochemical markers of muscle damage, higher rates of muscle myopathies, and potentially inadequate organ development. Fast growth rate coupled with high breast yield is associated with poor welfare outcomes."

The broiler chickens were raised in identical pens. Researchers observed their behaviour to quantify levels of activity, use of environmental enrichments and bird mobility. They also monitored litter quality and foot health

The future

Going forward, GAP will use the data from the study to help develop welfare standards and assessment protocols for the broilers they certify. According to its website, GAP has certified more than 1,200 products and 3,900 livestock farms. More than 5,000 outlets carry GAP-certified products.

"A number of retailers and companies in the food service industry will be using the GAP standards to obtain genetic strains that have better welfare outcomes," Widowski says.

In August 2021, seven large U.S. companies – including Aramark, Sodexo and Target – formed the U.S. Working Group for Broiler Welfare. By 2026, the group will compel suppliers to use broiler breeds whose higher welfare outcomes meet the criteria of the RSPCA Broiler Welfare Assessment Protocol or Global Animal Partnership. ■

GLOBAL ANIMAL PARTNERSHIP

SOCIAL MEDIA SURVEILLANCE COULD HELP PREVENT PANDEMICS

Twitter and Google could help predict infectious disease outbreaks in birds, animals and humans in the future, using a unique data-driven decision support system built by University of Guelph researchers.

"We were looking at how best we could predict the emergence of avian influenza, how best we could control it and how best we could protect other birds from catching the virus," says Dr. Shayan Sharif, a professor in the Ontario Veterinary College.

Sharif points out that avian influenza, like COVID-19, is a zoonotic pathogen, which is why he and his colleagues adapted their influenza results to examine the SAR-CoV-2 virus. Zoonotic pathogens can be transmitted from animals to humans and vice versa.

Rozita Dara
School of Computer Science

Zvonimir Poljak
Department of Population Medicine

Shayan Sharif
Department of Pathobiology

Avian influenza

Avian influenza killed tens of millions of poultry and waterfowl globally in the late 1990s through the early 2000s. It also killed hundreds of people, mainly in Asia, Africa and the Middle East.

"In the 1990s and 2000s, there was a fear that avian influenza could trigger the next human pandemic," Sharif says.

Dr. Rozita Dara, a professor in the School of Computer Science, is a specialist in artificial intelligence. She and her team helped develop the decision support system, which obtains data from different sources and integrates that data to provide decision-makers with a clear picture of incidents and whether they are related to health or almost anything else.

Dara and Sharif worked on the project with Dr. Zvonimir Poljak, professor in the Department of Population Medicine, and other researchers, including post-doc and first author Dr. Samira Yousefinaghani.

"We decided to look at different data sources and try to predict avian influenza with more information about the outbreak," Dara says.

They tried to get data from farm sources, but it either didn't exist or was not readily available for sharing. That's when they landed on querying several social media outlets that tracked what people were saying about avian influenza on Twitter. Using OIE World Animal Health Information System data on the actual outbreaks, they could validate the system's efficacy.

Using the system, they tracked Twitter posts from farmers, commodity organizations and others about worrisome signs – loss of appetite, coughing and sneezing – in chicken flocks. They used machine learning to train a digital surveillance system that monitored tweets from around the world 24/7. Between July 2017 and November 2018, more than 200,000 posts were tracked from several countries and the system proved to be 75-per-cent accurate in predicting the outbreaks. Fully one-third of the Twitter notifications were reported earlier than official notifications.

COVID-19

In the COVID-19 study, which ran from January to September, 2020, 300,000 tweets and Google search scores related to symptoms and preventive measures were gathered from the U.S. and Canada. For this study, the researchers used case and death data from the Johns Hopkins Coronavirus Resource Centre for validation purposes.

For Canada, they found that 80 per cent of the first waves could be predicted a week earlier than formal notifications using their decision support system. The first wave results were more strongly correlated between the online activity and actual outbreaks, probably because people were more knowledgeable about the virus by the second wave, resulting in fewer queries. Dara believes this powerful tool would be more efficient in the initial stages of an outbreak.

"Overall, our research shows how much Twitter and Google mimics the social and business activities that we have on a daily basis," she says.

She also cautions that this system is not a silver bullet for addressing a viral outbreak, and it takes a lot of work and collaboration to build the system.

"We're not prescribing what decisions people should make, we're just analyzing and providing information about the severity of the risk of the outbreak," she says. "We need to engage lots of stakeholders – epidemiologists, doctors, public health officials and others – to make sure that the tool is reliable, but it's a promising tool that can enable us to take action proactively, rather than waiting until the pandemic is upon us."

The approach has also been used to predict food-borne illness outbreaks.

Dara says high-quality data is crucial for decision-making to prevent outbreaks, and suggests that a government-run system would work best. ■

Sharif lab members, including graduate students, post-doctoral fellows and Dr. Shayan Sharif (centre)

FOOD FROM THOUGHT OPPORTUNITIES AND PROGRAMS

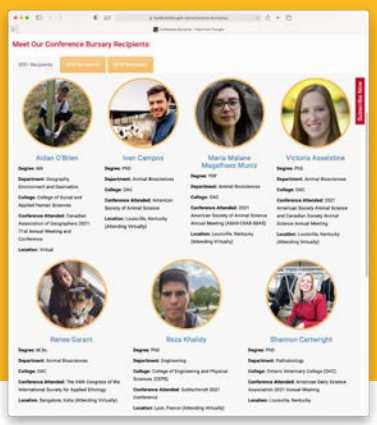
Conference bursaries

Food from Thought provides bursaries for graduate students and post-doctoral researchers four times per year to present their research at conferences, promote knowledge mobilization and develop partnerships for the Food from Thought program.

During COVID-19, the program has continued to support students' participation in virtual conferences, enabling future research innovators to hone their presentation and communication skills and share the results of their research projects aligned with Food from Thought objectives. Since 2017, Food from Thought has supported 71 graduate students with more than $117,000 in conference bursary funding.

Meet our 2020 conference bursary recipients:

Read about their research projects and their thoughts on the impact of the conference bursary program



Policy fellowship program

Launched in early 2018, the University of Guelph Policy Fellowship Program in Agriculture, Food and Biodiversity, funded by Food from Thought and administered by the Research Innovation Office, brings senior decision-makers from various levels of government, industry and NGOs to the University of Guelph to learn about cutting-edge research that can inform policy decisions and to connect with leading researchers in mutual areas of interest.

Despite physical distancing restrictions caused by the COVID-19 pandemic, the Policy Fellowship Program continued in a virtual format throughout 2020 and allowed 18 decision-makers in agriculture, food and biodiversity to meet with researchers and staff for in-depth discussions and knowledge exchange.

As of Fall 2021, the Fellowship program will have connected over 50 decision-makers from five federal agencies, six provincial governments and numerous industry associations and other organizations to University of Guelph research and expertise. All past Fellows have reported an excellent or very good experience with the program, yielding benefits such as evidence-informed policies and practice, collaborations between Fellows and faculty, and expanded networks.

The Policy Fellowship program continues to grow and has transitioned permanently to a hybrid model, offering both online and in-person programming.

WHAT DO PAST FELLOWS HAVE TO SAY ABOUT THE PROGRAM?

"The University of Guelph Policy Fellowship program was an invaluable opportunity to form relationships with faculty and learn about their work. Sitting down with researchers in a comfortable and informal environment and engaging in stimulating discussions was a richer experience than being one in the crowd during a seminar or conference."

David Hagarty, director, Ontario Farm Products Marketing Commission Secretariat

"What a wonderful experience! The program provided an opportunity to have in-depth conversations with industry leaders… to gain incredible insight into policy development and how to influence policy. I would not have been able to access such breadth and scope in knowledge and experience and gain this understanding outside of the fellowship."

Heather Watson, executive director, Farm Management Canada

Knowledge mobilization

Driving Research Impact with Knowledge Mobilization Grants

Making research accessible and translating findings into a format understood by audiences from various sectors is critical for research impact. One of the many ways that the Food from Thought program helps University of Guelph researchers maximize research impact is by providing knowledge mobilization grants.

Along with the collaboration with the Research Innovation Office, Food from Thought awarded $41,000 in 2020-21 to support knowledge mobilization activities, such as workshops and seminars, that encourage collaboration and dissemination of research results within and beyond the academic community.

Here's a glimpse of three knowledge mobilization projects that received funding in 2020:

1 DISSEMINATING KNOWLEDGE THROUGH INTERDISCIPLINARY CONVERSATIONS

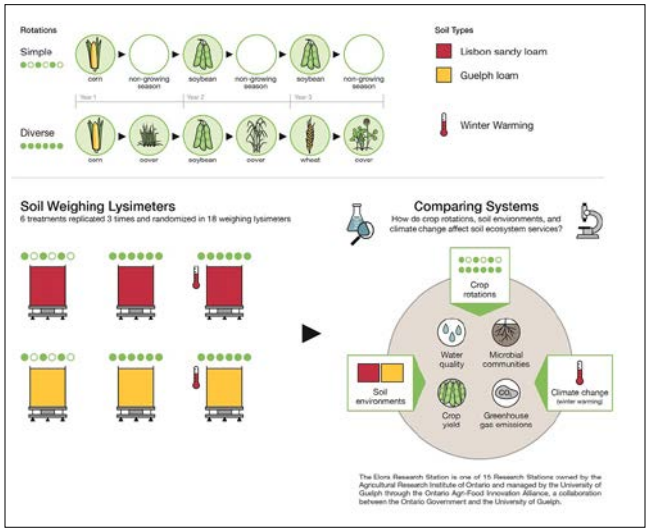
This knowledge mobilization (KMb) project through the Guelph Institute for Environmental Research at the University of Guelph brought together small teams composed of a student researcher, an end user and an artist to create arts-based KMb mechanisms to communicate Food from Thought research to end users. Designed to help disseminate environmental research and reconnect the arts and the sciences, the project involved a one-day workshop to provide training to the participants in the morning and opportunities for them to work on the KMb product in the afternoon. The resulting products were shared with the broader community during a symposium.

Conducting field work: Janean Sharkey in photo (left) and as depicted for this arts-based knowledge mobilization piece (right; illustration © Suzanne M. Matheson, 2021)

Take a closer look at the artistic creations from this KMb initiative.

2 MOBILIZING SOIL HEALTH RESEARCH THROUGH VIRTUAL EVENTS AT THE SOIL HEALTH INTERPRETIVE CENTRE

This project involved collaboration with the Ontario Agricultural College to reach high school students, farmers and certified crop advisers and invite them to attend virtual tours of the Soil Health Interpretive Centre (SHIC). The production of the virtual tours included filming of the lysimeters (large stainless steel cans of undisturbed soil that are placed into the ground to study water and nutrient balances in soil) at the SHIC and interviews with farmers and researchers. The final product is now being used during virtual events to educate target audiences about soil health research.



Learn more about the use of lysimeters at the Soil Health Interpretive Centre.

3 DISSEMINATING KNOWLEDGE ON GENOMIC INDICATORS OF AGRO-ECOSYSTEM SERVICES

This project involved the use of digital storytelling in the form of three short videos to share the results of a Food from Thought-funded research project by Dr. John Fryxell, a professor in the Department of Integrative Biology. Dr. Fryxell's research aims to develop innovative ways to link reliable field estimates of organism abundance with evidence of biodiversity obtained through metabarcoding, eDNA and image analysis of bulk samples.

John Fryxell
Department of Integrative Biology

The knowledge mobilization project team led by Hannah James, media and strategic communications manager with the Centre for Biodiversity Genomics (CBG), developed the short videos based on Dr. Fryxell's research to communicate information about biodiversity on farms, as well as to educate farmers about the malaise trap system (a tent-like structure used to catch flying insects).

The videos highlight various aspects of the research project, such as collecting specimens on farms, farmer interviews, native plants on farms and DNA metabarcoding in the CBG lab to identify species in a bulk sample of insects. ■

"While we push forward with conservation and regeneration of lands, it's also important to measure the biodiversity outcomes and illustrate how regeneration can benefit wildlife. This project could be a useful starting point for farmers to begin to think about adding some plants to their lands and how this could benefit their farming practice overall."

Hannah James, media and strategic communications manager, Centre for Biodiversity Genomics

Fryxell Lab researcher Patrick Burgess with a malaise trap bottle filled with insects ready for DNA metabarcoding analysis at the Centre for Biodiversity Genomics

TRAINING OUR FUTURE AGRI-FOOD LEADERS

TRAINING OUR FUTURE AGRI-FOOD LEADERS

In 2019, Food from Thought, in partnership with the Ontario Agri-Food Innovation Alliance, introduced a redesigned Highly Qualified Personnel (HQP) scholarship training program. The enhanced program included a new graduate-level training course offered to all students receiving funding through Food from Thought, the Ontario Ministry of Agriculture, Food and Rural Affairs HQP scholarship, and scholarship holders through the Arrell Food Institute. UNIV *6050: Innovation and Entrepreneurship in Agri-Food Systems is an eight-month course that exposes students students to a wide range of agri-food related challenges and that mentors students in the foundational skills of project management, teamwork, plain language communication and conflict resolution.

Each year, students are placed into multidisciplinary teams and are assigned a project defined by a non-academic partner. Each group is given a small budget and tasked with developing a work plan and final deliverables. Students are assessed on their project pitch, the best uses of social media and media training. Food from Thought is proud to offer this highly interdisciplinary course in partnership with colleagues from the Government of Ontario, the Gordon S. Lang School of Business and Economics, and the Arrell Food Institute at the University of Guelph. Through this unique experiential training and education, the University of Guelph is preparing graduates to bring leadership to solving the complex problems of this dynamic industry. ■

Graduate students involved in the HQP scholarship training program contribute to a FeedBack blog to share their experiences in the Innovation and Entrepreneurship in Agri-Food Systems course.

Here are contributions from 2020 HQP scholars Deus Mugabe and Joshua Barrett:

In his FeedBack blog called Mitigating Technological Disruptions in Canadian Agri-Food Sector, Deus Mugabe reflects on the possibilities and the future of cellular agriculture — the ground-breaking technology of artificially making animal-based food, leather and other products.

Joshua Barrett reflects on the importance of the Sustainable Agriculture Initiative Platform in his FeedBack blog, Agriculture and Sustainability: An Oxymoron or Stewards for Sustainability? The SAI Platform is a global not-for-profit organization committed to creating a sustainable, healthy and resilient agricultural sector.

Meet our 2020 HQP scholars and learn about what they are studying, what motivates them and what impact their research is poised to make on the agri-food industry.

HQP SCHOLAR'S RESEARCH EXPLORES WAYS TO FIGHT FOOD FRAUD

Maleeka Singh's experiences with two prestigious University of Guelph graduate student programs have helped increase her knowledge, boost her confidence in communicating complex scientific topics and point her on her career path.

"It was an amazing opportunity," she says of the Highly Qualified Personnel (HQP) scholarship program. "Not only was I able to pursue my graduate degree without having to worry about financial resources, but I was also able to build a network of peers and other academics across all colleges within the University."

Maleeka catalogues samples for her fish fraud research project

The HQP program is funded by Food from Thought and the Ontario Agri-Food Innovation Alliance, a partnership between the University of Guelph and the Ontario Ministry of Agriculture, Food and Rural Affairs. It aims to support the development of highly skilled graduate students who can meet the changing demands of the agri-food and rural sector. With this program, the University of Guelph is developing a vibrant talent pool of skilled, forward-thinking learners to take leadership positions in diverse jobs in the sector's businesses, governments, universities and non-profit organizations.

Many HQP participants – including Singh – work with researchers in the Food from Thought program to develop innovative solutions that improve the sustainability and productivity of agricultural production.

Singh was also able to collaborate with other HQP scholars on projects for community partners as part of the program.

"The HQP program helps to develop a sense of community, as well as promote an environment for personal and professional growth," she says, adding that her HQP mentors were excellent and made her student experience more rewarding.

One of her favourite activities was the media training workshop, which helped improve her confidence and increase her ability to use plain language to communicate complex scientific topics. It also prompted her to join the SPARK program (Students Promoting Awareness of Research Knowledge), where she used these knowledge translation and transfer (KTT) skills writing several news articles about research at U of G.

These KTT skills also helped in her application for her PhD and the Arrell Food Institute Scholarship, which she received in 2020. The Arrell Scholars program provides $50,000 per year to graduate students who demonstrate academic excellence and potential to build a healthier, more sustainable and more just food system. Each scholar takes part in an applied learning program to hone valuable leadership skills and build stronger networks in the agri-food sector.

For her master's project, she researched the top 10 most adulterated foods in the market, reviewed the DNA-based authentication methods that were published over the last 20 years for the detection of fish, tested a subset of these assays for validity, and tested a new DNA authentication method for identifying commercial species of fish.

"Overall, we found that there were gaps in the literature and that many of the published DNA-based assays were not necessarily fit for detecting relevant commercial species of fish," she says.

"It was an amazing opportunity," she says of the Highly Qualified Personnel scholarship program. "Not only was I able to pursue my graduate degree without having to worry about financial resources, but I was also able to build a network of peers and other academics across all colleges within the University."

Maleeka Singh

Singh worked with a number of other researchers to authenticate and validate FASTFISH-ID™, a new, portable tool for detecting fish species using closed-tube DNA barcoding.

"As this technology is quick, efficient, conducted in a single tube and requires minimal handling, we hope that it can be used along the supply chain for fish authentication," she says. With seafood accounting for 20 per cent of animal consumption globally, and more than 30 per cent of marine fish stocks harvested at unsustainable levels, being able to accurately identify fish species and prevent food fraud is important.

Singh went a step further in her research, contending that multiple methods for authenticating fish species should be used because, like many technologies, each method has its limitations.

Her research was important for ensuring that consumers get the product that they pay for and, ultimately, to ensure that food safety risks from adulterated products are minimized.

Her master's advisers were Dr. Jeff Farber, formerly director of University of Guelph's Director of the Canadian Research Institute for Food Safety, and Dr. Robert Hanner, Associate professor in the Department of Integrative Biology and member of the Biodiversity Institute of Ontario.

"Dr. Hanner and Dr. Farber have been real inspirations for me and sparked my interest in the food safety and food fraud space," she says. "Both are so knowledgeable and passionate – they motivated me to pursue my PhD to contribute to the sector."

For her PhD, she's working on using non-invasive biophysical methods like fluorescence fingerprints for detecting food integrity.

"We're using biological and chemical fingerprints to characterize the deteriorative properties of food," she says, adding that the ultimate goal is to increase food safety and quality and reduce food waste. ■

RESEARCH INVENTORY

Research inventory

DIGITAL AGRICULTURE RESEARCH PROJECTS

Enhancing Ontario's grain production using smart farming techniques
Asim Biswas and co-investigators: William Deen, John Sulik, Adam Gillespie, Prasad Daggupati

Accounting for soil organic carbon in profitability maps
John Lindsay and co-investigators: Adam Gillespie, Madhur Anand, Eric Nost, Ahmed Laamrani, Clarence Swanton, Paul Voroney, Wanhong Yang

Livestock visualization project: Using visual and spectral images to determine calf growth and performance
Medhat Moussa and co-investigators: Katherine Wood, Dan Tulpan

Utilizing data from automated calf feeders: Identifying novel ways to identify disease to improve growth and performance of dairy calves
Dave Renaud and co-investigators: Charlotte Winder, Michael Steele

Expanding the value of soil health and soil ecosystem services research through development of an integrated data-sharing platform
Claudia Wagner-Riddle and co-investigators: Kari Dunfield, Aaron Berg, Jon Warland, Hadis Karimipour, Evan Fraser

A cybersecurity monitoring and threat hunting system for protecting smart farming
Ali Dehghantanha and co-investigator: Andrew MacDougall

Enhancing the impact of agri-environmental research with repeat digital imaging
Claudia Wagner-Riddle and co-investigator: Aaron Berg

Applying wearable sensors and machine learning to improve dairy cow health and production
Eduardo Ribeiro and co-investigator: Dan Tulpan

Using deep learning as an analysis and decision-support tool to assess biodiversity gain from habitat restoration in the agri-food sector
John Fryxell and co-investigator: Graham Taylor

Informatics for single-specimen ecosystems
Paul Hebert

Development of near-real time analysis and reporting tool for important livestock pathogens
Zvonimir Poljak and co-investigator: Maria Spinato

Rapid assessments of farmland functional biodiversity and specific ecosystem functions
Dirk Steinke

ECOSYSTEM SERVICES RESEARCH PROJECTS

Eco-evolutionary dynamics and aquatic ecosystem services
John Fryxell and co-investigators: Andreas Heyland, Teresa Crease, Robert Hanner, Wanhong Yang

Genomic indicators of agro-ecosystem services
John Fryxell and co-investigators: Dirk Steinke, Robert Hanner, Elizabeth Mandeville, Paul Hebert

Terrestrial ecosystem services
Andrew MacDougall and co-investigators: Jana Levison, Kari Dunfield, Hafiz Maherali, Amy Newman, Brian Husband

Food security and the maintenance of aquatic ecosystem services
Kevin McCann and co-investigators: Robert Hanner, Neil Rooney, Karl Cottenie, Fred Laberge, Nicholas Bernier, Ryan Prosser, Elizabeth Mandeville, Tyler Zemlak

CROPS RESEARCH PROJECTS

Modelling and monitoring agroecological mosaic ecosystems for optimizing human-environment sustainability
Madhur Anand

Leveraging Canada's RADARSAT Constellation Mission for advances in precision agriculture and precision conservation
Aaron Berg

Development of a protocol and pilot study for nitrogen x water on-farm research
Bill Deen and co-investigators: John Sulik, Joshua Nasielski

Investigating the soil microbiome to understand soil health and soil ecosystem services
Kari Dunfield

Enhancing biodiversity of the agro-ecosystem by enhancing adoption of cover crops
Elizabeth Lee and co-investigators: Bill Deen, Dave Hooker, Nigel Raine, Kari Dunfield

Strategies for achieving simultaneous increases in bean crop agro-ecosystem diversity and productivity
Peter Pauls

Assessing and enhancing wild pollinator biodiversity
Nigel Raine

Improved approaches for management zone creation
John Sulik and co-investigator: Bill Deen

Enhancement of stress tolerance to weeds and cover crops
Clarence Swanton

Financial and sustainability assessment of precision agriculture in crop production
Alfons Weersink and co-investigator: John Sulik

LIVESTOCK RESEARCH PROJECTS

Precision poultry management: Combined approaches for enhancing layer health and welfare in the context of sustainable high egg production
Grégoy Bédécarrats and co-investigators: Elijah Kiarie, Tina Widowski, Alexandra Harlander

Development of novel biomarkers for stress, boar taint and reproductive performance in pigs
Renée Bergeron and co-investigators: James Squires, Julang Li, Lee-Anne Huber

Breeding livestock for climate resilience
Bonnie Mallard and co-investigators: Angela Cánovas, Dan Tulpan, Flavio Schenkel, Niel Karrow

Precision cattle management
John Cant and co-investigators: Katie Wood, Trevor DeVries, Michael Steele, Vern Osborne, Eduardo de Souza Ribeiro, Dave Renaud

A comparison of key methodologies used to quantify protein quality of insect protein, black soldier fly larvae, for human and farm animals
Kate Shoveller and co-investigators: Lee-Anne Huber, Elijah Kiarie, Michael Rogers

Mechanisms of long-term consequences of transition cow biology on production and reproduction traits
Eduardo de Souza Ribeiro

A comprehensive assessment of slow-growing chickens: Tackling sustainability issues for chicken strains of tomorrow
Tina Widowski and co-investigators: Elijah Kiarie, Ira Mandell, Niel Karrow, Dan Tulpan, Shai Barbut

PATHOGENS RESEARCH PROJECTS

Improving antimicrobial stewardship in food animals by identifying the determinants of use of antimicrobials by veterinarians and dairy farmers

Stephen LeBlanc and co-investigators: David Kelton, Dan Tulpan, Jan Sargeant

The use of big data to predict the emergence of food-borne outbreaks

Lawrence Goodridge and co-investigators: Jeff Farber, Rozita Dara, Amy Greer

Is it possible to control transmission of avian influenza virus?

Shayan Sharif and co-investigators: Zvonimir Poljak, Rozita Dara, Amy Greer

Control of food-borne pathogens

Lawrence Goodridge and co-investigators: Jeff Farber, Gisèle LaPointe, Nicole Ricker

Identification of factors contributing to *Streptococcus suis* disease in pigs: Big data approach

Zvonimir Poljak and co-investigators: Amy Greer, Brandon Lillie, Vahab Farzan, Nicole Ricker, Robert Friendship, Davor Ojkic

BIODIVERSITY RESEARCH PROJECTS

Tracking the response of arthropod communities to changing environments (TRACE)

Paul Hebert and co-investigators: Dirk Steinke, Sujeevan Ratnasingham, Jeremy deWaard, Evgeny Zakharov

Centre for Biodiversity Genomics (CBG) Platform

Paul Hebert and co-investigators: Dirk Steinke, Sujeevan Ratnasingham, Jeremy deWaard, Evgeny Zakharov

INTEGRATED FOOD SYSTEMS RESEARCH PROJECTS

Exploring novel agricultural frontiers

Evan Fraser and co-investigators: Aaron Berg, Kevin McCann, Khurram Nadeem, Krishna KC

Human dimensions of the digital agricultural revolution

Evan Fraser and co-investigators: Dan Gillis, Rozita Dara, Alfons Weersink, Shoshanah Jacobs, Eric Nost, Rebecca Hallett, Krishna KC

PARTNERS

The funding provided to Food from Thought from the Canada First Research Excellence Fund has enabled researchers at the University of Guelph to strengthen existing partnerships and attract new supporters and collaborators, multiplying the resources available to achieve our mission. More than 100 partners have contributed more than $30M cash and $64M in-kind support of Food from Thought research to date. Key partners include:

CANADIAN RESEARCH INSTITUTIONS

Centre for Biodiversity Genomics
University of Guelph
University of McGill
University of Victoria

PUBLIC SECTOR

Agriculture and Agri-Food Canada
Canadian Food Inspection Agency
Dairy Farmers of Manitoba
Fisheries and Oceans Canada
Innovation Guelph
Ocean Networks Canada
Ontario Agri-Food Alliance
Ontario Bean Growers
Ontario Centres of Excellence
Ontario Genomics – GAAP
Public Health Agency of Canada
Pulse Science Cluster
SOSCIP
Tokyo University of Marine Science and Technology
University of Leeds
Wageningen University and Research Center
Institute of Oceanology – Polish Academy of Sciences
University of Maryland
British Columbia Dairy Association
SaskMilk

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Ajinomoto Inc.
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Bayer Animal Health
Dairy Farmers of Canada
Enviroflight
Foerster Technik
IBM Canada
Lallemand Animal Nutrition
Loblaw
Maple Leaf Foods
Promat Inc.
Semex Alliance Inc.
Trouw Nutrition
Woodrill
Wallenstein Feed & Supply
Hakai – University of Victoria
Westgen
Hogendoorn Dairy

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Egg Farmers of Canada
Egg Farmers of Ontario
Global Animal Partnership
Grain Farmers of Ontario
Great Lakes Fishery Commission
Hensall District Co-Op
Ontario Pork
Ontario Sheep Farmers
Toronto and Region Conservation Authority
Chicken Farmers of Saskatchewan

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Food from Thought

UNIVERSITY of GUELPH

FOOD FROM THOUGHT

CANADA FIRST RESEARCH EXCELLENCE FUND

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