UNIVERSITY of GUELPH

OMAFRA-UNIVERSITY OF GUELPH AGREEMENT

research

Volume XXXV · Number 1 · Summer 2018

How sweet it is

Following an innovative molecule's pathway from Ontario sweet corn fields to a new R&D and manufacturing facility

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Ontario

2017–18 AGRI-FOOD YEARBOOK

Ontario innovations, global impact

Welcome to the Summer 2018 edition of the Agri-Food Yearbook for the partnership between the Ontario Ministry of Agriculture, Food, and Rural Affairs and the University of Guelph.

This issue highlights how research and innovation are key contributors to the strength of Ontario's agri-food industry. They drive industry competitiveness and market expansion, and capitalize on new and emerging opportunities in food, health, the environment and agri-technologies.

That's why strong partnerships, like the world-renowned relationship between the Ministry and the University are so important.

The partnership powers research and innovation in agri-food, a key economic sector for this province and this country.

Scientific research in agri-food is critical in the drive towards innovations that help create jobs and improve the economy, and sustain and contribute to safe food, a healthy environment and strong communities.

The University of Guelph is recognized as one of the country's most inventive universities, exceling in agricultural and veterinary science. As Canada's food university, it prides itself particularly on research and innovation in agri-food, a key economic sector for this province and this country. The university has built on its 150-year legacy in agri- food innovation and discovery to become the epicentre of agricultural research and innovation for all of Canada.

Provincial investments in U of G research have yielded new crop varieties, healthier animals, safer food, and a better environment.

A pivotal element in University's success is the unique, long-standing partnership with the Ministry. The partnership supports global leadership in agri-food research and innovation, veterinary medicine, environmental sciences and rural economic development.

Under that partnership, provincial investments in U of G research have yielded new crop varieties, healthier animals, safer food, and a better environment.

This partnership has yielded fantastic results. In 2016–17 alone, $49-million worth of external research funding was leveraged because of the agreement. Additionally, more than 180 agri-food graduate students were engaged in research.

This support provided students with the necessary specialized and practical training to ensure that they were ready to work in and contribute to this growing sector.

In 2018, the University and the Ministry entered into a new agreement to support world-class research, education and innovation. This agreement includes up to $713 million in strategic investments over 10 years that will help secure Ontario's position domestically and globally as a leader in agriculture and food.

The Ministry and the University continue turning research knowledge into value-added products, technologies, and solutions to make Canada a global leader in agri-food, to meet critical challenges of today and tomorrow, and to realise the University's motto to "Improve Life" at home and abroad.

Going forward, the agreement between the Ministry and the University will continue strengthening agri- food research and innovation and food safety; protect plant, animal and human health; and promote development of a highly skilled and competitive workforce — provincially, nationally and globally.

Photo: Alamy

research

Volume XXXV · Number 1
Focus:
OMAFRA-U of G Agreement

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PUBLICATION MAIL AGREEMENT NUMBER
40064673

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ISSN 0841-9494

Ontario

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IMPROVE LIFE.

U of G physics professor John Dutcher (centre) is flanked by his lab members outside the new production facility being built in Guelph for PhytoSpherix, a sweet corn-based molecule discovered in his lab. See page 32.

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Photos: Martin Schwalbe (above and front cover)

Thumbs-up for agriculture-University agreement renewal

Prof. Alison Duncan: "The students graduate, get jobs and contribute their expertise to building up the agri-food sector in Ontario."

The **innovations** that come out of labs and fields supported by the partnership turn into local businesses and jobs. A dozen active companies have already spun off from University of Guelph **research** supported by the partnership.

Owen Roberts

One of the biggest research developments in the University of Guelph's history took place in September of 1997 — that's when the University and the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) deepened their long-standing relationship with a formal agreement for research.

The agreement was designed to give unprecedented and unparalleled cohesiveness to Ontario's agri-food structure. It supports research that provides safe food, grows Ontario's capacity to produce food, supports a globally and domestically competitive agri-food sector, and protects animal, plant and public health and the environment.

As well, the agreement provides the foundation, infrastructure and critical mass of experts who are equipped to address challenges staring us in the face, such as how to feed a growing population. It addresses hidden challenges through testing in the Animal Health Laboratory and Agri-Food Laboratory — testing that helps keep food and livestock safe while staving off imminent problems percolating mostly unknown to the public.

Over the past two decades, the relationship has flourished. And earlier this year, the University and the Ministry announced a $713-million, 10-year provincial investment to renew and further strengthen the agreement.

University of Guelph President Franco Vaccarino says that renewed commitment makes the University the "epicentre of agricultural research and innovation for all of Canada." It leaves no doubt that U of G is indeed Canada's food university, and that the Ministry is solidly behind research that helps Ontario grow.

The agreement sparks employment and investment. Some of the innovations that come out of labs and fields supported by the partnership turn into local businesses and jobs. A dozen active companies have already spun off from University of Guelph research supported by the partnership.

For example, look at the new development in the city's industrial park. There, Mirexus, a company created following the discovery of a unique sweet corn-based chemical called PhytoSpherix by University of Guelph physics professor John Dutcher, has turned into a leading-edge international business. Construction is under way in the industrial park for a headquarters, laboratory and manufacturing facility. Ultimately, more than 70 jobs will be created.

Part of the research that went into helping advance PhytoSpherix came from the OMAFRA-U of G agreement.

Photo: University of Guelph

The research agreement between the University of Guelph and the Ontario Ministry of Agriculture, Food and Rural Affairs has sparked new developments in crops and livestock and boosted the province's economy.

And look at the Guelph-based animal genetics company called Semex. It's commercialized high-immune response (HIR) technology developed at the University by immuno-genetics professor Bonnie Mallard that singles out cows with natural disease immunity. This reduces the need for antibiotics, saving farmers millions of dollars a year, and leads to a safer food system.

It's caught on globally. Semex has already sold $100-million worth of HIR genetics, called Immunity+, in 80 countries. The OMAFRA-U of G partnership helped HIR technology reach the commercial stage.

The agreement is also directly helping Guelph families, through the landmark Guelph Family Health Study. This extensive, 20-year research project has already involved hundreds of people in the Guelph area. By the age of five or six, kids form eating, exercise and sleep habits that can last a lifetime. This study is testing new ways for kids to learn healthy habits early — habits that can significantly lower their risk of disease now and in the future.

University of Guelph students benefit from the agreement's high-quality personnel development and by being part of the agri-food research process itself. During the partnership renewal announcement, Prof. Alison Duncan, Human Health and Nutritional Sciences, said the partnership fosters connections among agriculture, food and human health, and involves students in the mix.

Many of the crop and livestock **innovations** on Ontario farms are the result of research at the University, supported by the Ministry.

"The entire process builds capacity in everyone involved, particularly students who, through experiential learning opportunities, grow to understand the strong results of collaborative effort," she said. "The students graduate, get jobs and contribute their expertise to building up the agri-food sector in Ontario."

The $713-million investment is going into an institution with a proven track record in the agri-food sector. The University and Province have cooperated on agriculture and food research for 150 years.

Many crops grown by Ontario farmers started with germplasm created through research at the University, supported by the Ministry. The same goes for advances in livestock production and veterinary medicine and science. And healthful food, developed through research studies, is an imperative that goes back to the Macdonald Institute, established in 1903 as one of the University's founding colleges.

Malcolm Campbell, vice-president (research), says one of today's great global challenges is to safely feed the world's rising population while protecting the environment.

"It's a hefty challenge, but U of G, as Canada's food university, is up to the task," he says. "We have a legacy in agri-food and a reputation for innovation and discovery."

Photos: Beef Farmers of Ontario (top), Asparagus Growers of Ontario

Big data and blockchain technology

U of G teams up with companies and organizations to capitalize on this technology's potential for the agri-food sector

Innovating in Ontario articles written by Robyn Meerveld

Historically, research has been a long-term investment. Whether the subject was health care, engineering or agri-food sciences, advancements have been mostly incremental. Over the long term, the small but steady gains have brought us to current yields, efficiencies and knowledge that were previously unimaginable.

In the last decade, the research paradigm has shifted. Thanks to a proliferation of "smart" and interconnected digital devices, the volume of research data and the speed at which it can be generated has grown exponentially. Increasingly sophisticated software and deep machine learning has increased the complexity of analyses and accuracy of forecasts based on past, "learned" outcomes.

Blockchain technology's potential application to agri-food systems also opens a new landscape of opportunities. Originally developed for cryptocurrencies such as Bitcoin, blockchain technology is a kind of ledger distributed across many computers, all linked together in the cloud. Each block is encrypted for privacy and protection of information. Transactions recorded on the ledger are visible to all participants who have access to the chain, and this transparency reduces the opportunity for fraud.

Blockchain is finding new applications across a wide range of economic activities, including agriculture. For example, the technology could be used to record the details of agri-food products moving from farmers all the way to consumers, with entries made and verified at each step in the production chain. U of G has partnered with IBM Canada and industry groups such as SoyCanada and Grain Farmers of Ontario to look at ways of applying the system for expansion of export markets, where authentication is an important selling tool.

As with the Green Revolution of the 1960s, many view these digital developments as the next revolution in agriculture — with unprecedented opportunities to improve the world's food systems. But a myriad of issues surround the data itself: ownership, privacy, sharing, storage, compatibility of formats, availability of analytics and many others.

The renewed partnership between the Ontario Ministry of Agriculture, Food and Rural Affairs and the University of Guelph advocates for increased sharing and access to publicly funded data as one of its fundamentals. This is in line with the broad Ontario government mandate of open access and increased transparency. Sharing of data encourages third party collaboration and investment in new research, which further leverage the province's investment in the partnership.

U of G's Food from Thought research project is an example of the application of big data and data sharing, development of new platforms and analytics to a compelling global need: increasing food production for the world's growing population while protecting environmental ecosystems.

If ever there was a complex challenge in need of our most innovative approaches, this is it. Read more about Food from Thought and U of G's plans for groundbreaking digital developments on page 10.

Illustration: dencg/Shutterstock.com

Systematic reviews and meta-analyses of data related to Q-fever vaccine effectiveness for sheep have been conducted at the University of Guelph.

Deeper analysis means better answers

One of the greatest challenges of big data for researchers is the sheer volume of information generated by the rapidly expanding number of studies on any given subject. Another is the wide range of conclusions at which seemingly similar studies arrive. For example, consider the many conflicting reports about the benefits or hazards of a particular food or ingredient, depending on which study is quoted.

For most research questions, more studies won't necessarily solve the problem. But there is a means of addressing these challenges that is widely accepted and can deal with large amounts of data. Two of these methods are systematic reviews and meta-analyses. Often used together, they can provide a more definitive answer to a specific question than is possible with a single study.

The systematic review uses existing research studies that fit a set of predetermined criteria to answer a specific research question. The meta-analysis applies statistical methods to the data pooled from those studies that fit the criteria.

Both tools have long been the standard for evidence-based medical research in human health fields. Now they're being increasingly adopted in veterinary and agri-food sciences.

Leading the charge at the University of Guelph has been Prof. Jan Sargeant, director of the University's Centre for Public Health and Zoonoses (CPHAZ), funded in part by the OMAFRA-U of G Agreement. She's published extensively on the application of these methods to questions of animal health (syreaf.org), animal welfare and food safety. She's also undertaken many systematic reviews and meta-analyses including:

- Prevalence of chronic conditions in humans (such as inflammatory bowel disease) following food-borne illnesses;
- Prevalence of listeria in ready-to-eat foods;
- Effectiveness of interventions to reduce food-borne pathogens in animals — including vaccines and direct-fed antimicrobials to reduce *E. coli* 0157 in cattle;
- Effectiveness of Q-fever vaccines in small ruminants (sheep and goats) and in occupationally exposed humans; and
- Evidence for human health impacts associated with living near confined animal feeding operations.

As health care costs continue to increase, allocation of public resources to research studies can be expected to rely increasingly on these methodologies to provide "evidence-based" outcomes.

CPHAZ receives funding from the OMAFRA-U of G Agreement.

Photo: Owen Roberts

Driving agri-food innovation — digitally

Precision agriculture has expanded across a range of farming applications in Ontario since it was first associated with GPS and computerized cropping programs. While the programs' analytics have continued to improve, precision cropping can be challenging. In the open ecosystem of a farmer's field, conditions are variable and always changing. Research funded through the OMAFRA-U of G Agreement continues to generate new knowledge about the many factors affecting yields, aimed to reduce cost and increase environmental effectiveness.

Other digital tools have also been developed that help to optimize outcomes in field cropping:

- Decision-support apps to select the best field cover crops, and crop rotations to maintain or improve soil health and crop yields;
- A cost/benefit comparison of digestate vs. manure for land application to improve soil fertility; and
- A decision-support app to select the most appropriate vegetative filter strips to protect farmland waterways.

Keeping it green

Greenhouse acreage in Ontario has grown by more than 20 per cent over the last five years. Increasingly efficient digital devices have been a big part of the success. Automated sensors trigger irrigation, fertilization and heating only as needed, saving water, fuel, energy and labour costs.

Partnership research has developed water recycling systems that address issues of potential pathogens, chemical contamination and nutrient imbalances. Other computer apps provide greenhouse operators with pest identification and decision support for their integrated pest management systems. And the most visible application of big data in greenhouse operations has been the development of a robot with the sensory ability to identify disease and pick fruits and vegetables — only when they are ready, and oh-so-gently.

Big data in the barn

In Ontario, there's been a significant trend for "tie-stall" dairy operations to transition to milking parlours and robotic milking. The data systems automatically collect information on milk quantity, quality and flow and the behaviour of individual cows. Built-in analytics translate these factors into performance measures that can easily be tracked by the farmer. They also alert farmers of any irregularities. For example, a cow-side hand-held device called GryphSens, developed through partnership research, measures metabolic disease indicators so treatment can begin earlier, where needed.

This research is funded by the OMAFRA-U of G Agreement.

Photos: Ontario Ministry of Agriculture, Food and Rural Affairs

Conditions are variable in the open ecosystem of a farmer's field, as shown on this monitor.

Leveraging a partnership to feed the world

Food from Thought, and the specialized capacity built by the OMAFRA-U of G Agreement

The world's population will reach an estimated 9.6 billion people by 2050. One of the most significant challenges in producing more food will be the expected effect of environmental factors (e.g., global warming, droughts) on agriculture and, conversely, agriculture's impact on the environment.

At the same time, better economic opportunities are needed for the millions of subsistence farmers in regions of the world where farming yields are low and risk to the environment is high.

Against this backdrop is the growing capacity of big data to address increasingly complex challenges. This is the basis of Food from Thought, U of G's largest-ever federally funded research project. Multi-year and multidisciplinary, it's aimed at developing digital tools to increase global food production while protecting environmental sustainability and biodiversity.

A key partner is IBM Canada, involved extensively from research collaborations and data analytics tools, to training and secure cloud-based storage. The OMAFRA-U of G Agreement's programs will also continue to contribute significantly with new knowledge. The University will tap many other partners around the globe including government agencies, academic and innovation centres, and industry leaders — all working toward solutions to this global challenge.

One of the first steps will be to address the issues of big data in agriculture, as well as the changing climate and technologies that may affect food production globally. At the same time, U of G and its partners will launch a major online digital platform with advanced analytics to enable broad access to research data generated by participating partners in the academic, public and private sectors.

Arrell Food Institute scholar Karthika Sriskantharajah takes part in a farm tour of U of G research facilities, sponsored by Food from Thought.

Researchers from across U of G will examine key components of global food and environmental issues, applying the tools of big data to develop solutions such as:

- Reduced pesticide use on farms, protection of watershed health and identification of crops suited to the effects of climate change;
- Better tracking of emerging infectious disease threats to livestock, and control of pathogens in the food supply;
- Expanded use of DNA barcoding technology developed at U of G to identify food fraud, food-borne ailments and invasive pests, and to improve environmental impact assessments; and
- Software that combines input and labour cost information with crop yield data to create prosperity maps, allowing farmers to see the economic advantages of returning underperforming land to natural habitats for ecosystem benefits.

The new knowledge and technologies generated from this research will not only support environmentally sustainable intensification in Ontario's agriculture, but will also provide solutions with global applications as well.

Food from Thought is funded by the Canada First Research Excellence Fund.

Photos courtesy of Food from Thought

U of G and its partners will launch a major online digital platform with advanced analytics to enable broad access to research data generated by participating partners in the academic, public and private sectors.

Leah Blechschmidt is a Food from Thought graduate research assistant.

Digital developments mean improved environmental sustainability

The movement of nutrients through soils depends on many factors including soil moisture, composition, organic matter content and ground slope. Nitrogen and phosphorus — so essential to soil productivity — can adversely affect both surface and groundwater quality. Preventing contamination by nutrients is a concern not only for producers, but for all downstream users.

Research funding from the OMAFRA-U of G Agreement has generated new knowledge about the myriad of factors influencing nutrient movement in soils. Using advanced digital tools such as automated moisture sensors with interconnected digital devices, researchers can model combinations of agricultural practices to identify which are most effective at keeping nutrients on-farm and out of water bodies.

Other recent digital developments for improved environmental sustainability include:

- Computer programs that improve the accuracy of watershed maps by compensating for inherent errors in mapping;
- Inexpensive nitrogen and microbial soil tests for improved yields in subsistence farming;
- Wireless sensor networks adopted by conservation authorities for detecting soil moisture and runoff;
- Performance standards for co-substrates in anaerobic digesters to optimize clean burning and energy efficiency;
- Commercialization of green roof technologies for northern climates that reduce plant growth time and make installation easier;
- New cropping strategies to reduce phosphorus loss and greenhouse gas emissions, and maintain soil moisture and microbial diversity.

The green roof on the U of G's Science Complex is adapted for northern climates.

New research knowledge from these projects is shared with Ontario producers through publications such as OMAFRA's Best Management Practices. Workshops can also be an effective means of knowledge transfer. The Canada-Ontario Environmental Farm Plan sessions have been attended by 40,000 Ontario producers to-date.

Researchers share their findings with government environmental managers, so the objectives of public policies and programs being developed can be truly "evidence-based." They also publish their findings in scientific journals, advancing the level of understanding for future studies.

The benefits of the research don't end there. Students are a key component of research teams, and their time spent working alongside faculty helps provide them with the skills and experience for tomorrow's workforce. Annually, through the partnership's various programs, hundreds of students have the opportunity to see firsthand how innovative thought leads to new practices and technologies, and ultimately builds a more sustainable future for Ontario agriculture.

This research is funded by the OMAFRA-U of G Agreement.

The Gryphon's LAAIR program is helping refine an airlift pump developed by engineering professor Wael Ahmed to deliver water and nutrients more efficiently for aquaculture, greenhouses and other potential agri-food applications. The pump is part of a display pictured here, at last year's Royal Agricultural Winter Fair.

Moving innovations to market

Research has improved food production and rural communities through a wide range of innovations — from tools for rural economic development and genetically healthier animals, to more efficient milking systems and breeding of drought-resistant crops.

Most innovations are not proprietary but can provide real benefits (including financial ones) to early adopters. For example, producers who have adopted more complex crop rotations than the traditional corn and soybeans may see better yields and reduced need for inputs, according to research by U of G plant agriculture Prof. Bill Deen. As the new knowledge becomes more widely used, it benefits the entire sector.

But other innovations can generate intellectual property and may be worth protecting in law. That's where U of G's Research Innovation Office (formerly called the Catalyst Centre) professionals can help. They provide detailed advice to researchers about the various options available to them. Since 2013, the Research Innovation Office has helped researchers overcome some of the many hurdles of commercialization through a funding program called Gryphon's LAAIR (Leading to Accelerated Adoption of Innovative Research).

Successful applicants receive grants to identify potential markets, conduct business analyses, further develop their product to meet market needs and/or explore potential commercial alliances — all to improve the financial prospects of their innovation for potential investors. In 2017, 16 new technologies were funded, bringing the total of Gryphon's LAAIR projects to 49.

This program is funded by Growing Forward 2, a federal, provincial and territorial initiative, and through the OMAFRA-U of G Agreement.

Photo: Wael Ahmed

Elora: Where research is farm- and field-tested

| Owen Roberts

The Elora Research Station is one of the largest agricultural research farms in Canada, covering 2,310 acres. It's designed to support intensive research in crops, soils, beef and dairy.

Crops

A variety of research programs use the 400-acre crops research portion of the Elora Research Station (Crop Science). Breeding programs in cereals (wheat, barley and oats), corn, edible beans, soybeans, canola and forages have run since the station's establishment in 1969.

The station undertakes herbicide evaluation and development trials, forage and pasture management, potato, native flower and cole crop development, and supports varied graduate student projects. Researchers also evaluate the effects of crop rotations on soil structure, crop performance and manure management.

Dairy

The Elora Research Station – Dairy Facility is often called the world's most advanced state-of-the-art dairy research station, drawing visitors from across the globe. The $25-million, 175,000-square-foot facility was completed in May 2015, and is a joint project of the Agricultural Research Institute of Ontario (ARIO), the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA), the University of Guelph and the Ontario dairy industry represented by the Dairy Farmers of Ontario.

Its unique design allows researchers to conduct a wide range of research projects with adaptable, leading-edge technologies, while supporting education and training. Research at the facility includes optimal weaning strategies, genetics of feed efficient cows and reduced methane emissions, and best management practices for new technologies such as automated milk feeders for calves.

Beef

Also in Elora, construction of a new $15.5-million beef research centre is under way, developed jointly by the ARIO, OMAFRA, the Beef Farmers of Ontario (BFO) and the University of Guelph. Owned by ARIO, the centre will be run by U of G. The Canadian government is also contributing $2 million toward equipment at the centre.

"The existing Elora Beef Cattle Research Centre is the only remaining facility in eastern Canada that has the capacity to conduct beef production research on a meaningful and integrated scale," says BFO president Joe Hill. "The new facility will support and attract researchers who are interested in advancing livestock research in various areas from forage production to genetics, cattle production and feeding, food safety and beef quality."

Photos: Richard Seck

The Elora Research Station – Dairy Facility draws dairy industry visitors from around the world. Researchers conduct a wide range of projects with adaptable, leading-edge technologies. The centre also has education and training facilities to support innovation in Ontario's dairy industry.

Unique research program targets fusarium head blight

Owen Roberts

For researchers at the University of Guelph, addressing fusarium head blight — one of wheat's most nagging diseases — has been an agronomic time trip through the geography and history of Canada.

The researchers, led by plant agriculture professor Ali Navabi, "travelled" from the 1880s to today to look at the genetic diversity of 450 unique historical and modern winter wheat samples, gathered from multiple locations across the country. They call this collection the Canadian Winter Wheat Diversity Panel.

In 2017, as a nod to Canada's sesquicentennial, program participants grew multiple plots from each sample in field trials at the Elora Research Station to look for numerous agronomic traits, including response to fusarium head blight.

The researchers wanted to find wheat varieties with genes that offer the most natural resistance to the disease. They continue working toward identifying genes and developing tools for breeding programs to more effectively select for genetic resistance.

Navabi and his lab have tested the collection for 90,000 DNA markers, small pieces of DNA with known locations on the genome that are used in plant breeding and genetics research to study variation. That process is called genotyping.

His lab will use this information, along with the response of wheat lines against fusarium observed in the field, to associate selected DNA markers with greater resistance.

"Identifying these genes can help with fusarium-resistant variety selection and the development of new varieties with greater natural resistance," says Navabi, who holds the Grain Farmers of Ontario Professorship in Wheat Breeding at the University.

Plant agriculture graduate student Andy Chen is surrounded by test plots involving 450 unique winter wheat samples.

The wheat breeding program is intended to develop novel wheat and barley varieties with improved agronomics adapted to southwestern Ontario, to understand the genetics and genomics of important wheat characteristics, and to train highly qualified personnel.

The research team members from a wide array of backgrounds and nationalities reflect Canada's diversity and multiculturalism. The 15 participants in Navabi's lab collectively speak 13 languages other than English.

But they all have a common purpose — to improve profitability and sustainability for Ontario wheat producers.

Wheat grows on about one million acres of farmland in the province, with the overwhelming majority being winter wheat. Soft-red winter wheat represents about 90 per cent of the wheat grown here.

"Winter wheat is important in Ontario, as part of a healthy cropping system," says Navabi. "It improves nutrient use efficiency, reduces erosion and runoff, and serves as a cover crop. It's not just another cash crop."

His lab closely collaborates with the wheat team at the University of Saskatchewan, where researchers are trying to better understand the highly complex wheat genome. That genome consists of about five times more DNA than that in the human genome.

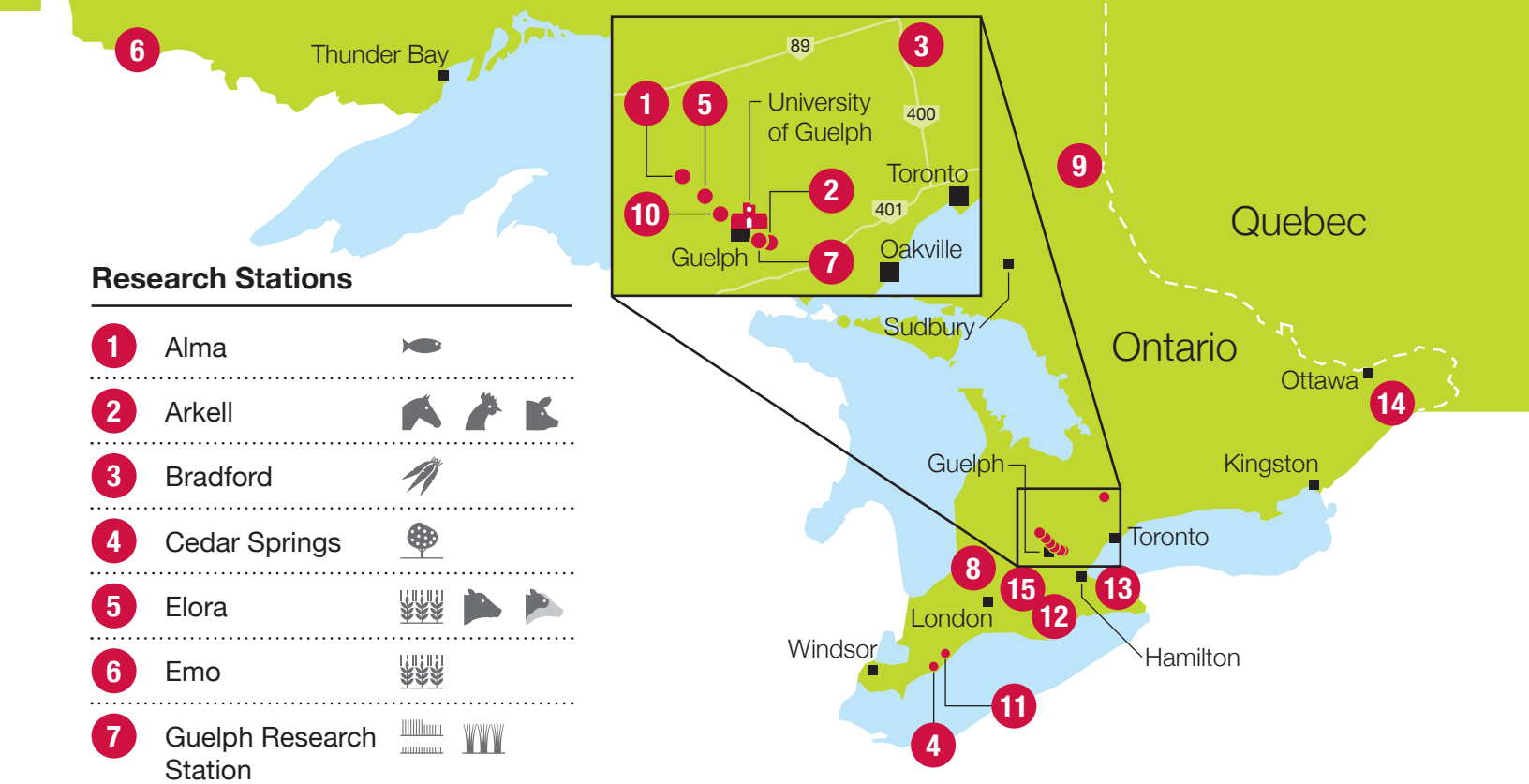
Many crop research projects end in the fall, after harvest, but not winter wheat research. Through to next spring, the research team will also assess the many samples at Elora for winter hardiness, an important element in the crop's sustainability.

This research is supported by Agriculture and Agri-Food Canada, SeCan, Genome Canada, and the OMAFRA-U of G Agreement.

Photo courtesy Ali Navabi

Ontario's agricultural research stations

Research stations and the infrastructure that supports them are vital for a wide range of innovative studies, and offer a platform for extension and teaching demonstrations. These research facilities, owned by the Agricultural Research Institute of Ontario and administered by the Ontario Ministry of Agriculture, Food and Rural Affairs, are operated and managed by the University of Guelph through the OMAFRA-U of G Agreement.



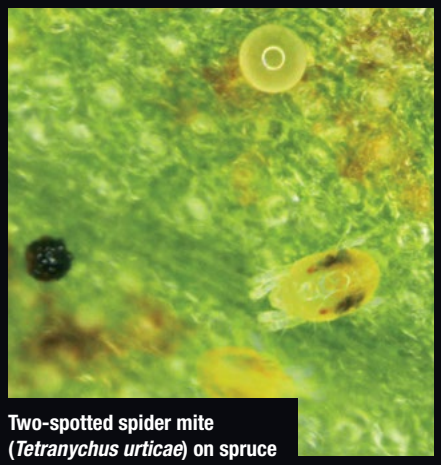
Research Stations

1. Alma
2. Arkell
3. Bradford
4. Cedar Springs
5. Elora
6. Emo
7. Guelph Research Station
8. Huron
9. New Liskeard
10. Ponsonby
11. Ridgetown
12. Simcoe
13. Vineland*
14. Winchester
15. Woodstock

* The Vineland Station is operated by Vineland Research & Innovation Centre with support from the OMAFRA-U of G Agreement.

Research Station Focus

- aquaculture
- beef
- biomass crops
- dairy
- equine
- field crops
- general animal facility
- horticulture crops
- vegetables
- poultry
- sheep
- swine
- turfgrass



Two-spotted spider mite (*Tetranychus urticae*) on spruce

Bacterial brown spot (*Acidovorax avenae* subsp. cattleyae)

Nematode (*Helicotylenchus* sp.)

Common plant pathogens

It starts with a hunch

Robyn Meerveld

When growers detect a pest problem, they need to act fast. And when they can't identify the pest, they need answers immediately, to prevent it from spreading. That's where the University of Guelph's Plant Disease Clinic can help.

Located at the University's Agriculture and Food Laboratory (AFL), the clinic serves growers, agri-businesses, researchers, provincial and federal governments, and landowners across Canada. The clinic deals with diseases and pests in greenhouse vegetables, annual and perennial ornamental plants, field crops, berry crops, tree fruits, turfgrass and trees.

Sometimes the disease agent is hiding in the soil or irrigation water, and that's important to know. For example, growers considering planting a new field will want to know whether soil nematodes will be a problem. Greenhouse operators considering water recycling may be concerned about spreading disease through the system.

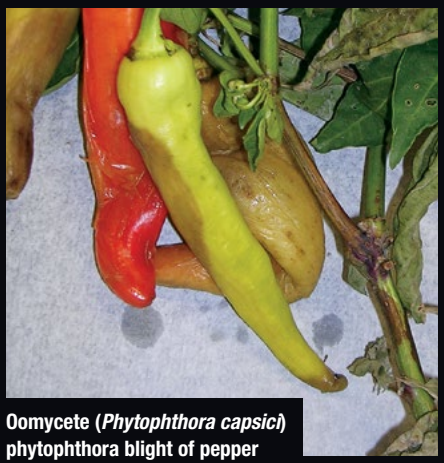
The clinic has identified a wide variety of pests — from insects, bacteria and fungi to viruses, nematodes and oomycetes — since 1978. In 2017, it received more than 6,500 samples of plant material, soil and water for pest identification. The plants came from more than 100 genera (one genus may include many species) and some were tropical and/or not native to Ontario, increasing the challenge and range of disease possibilities.

With an almost endless list of critters to consider, where do the scientists start? With the lab's state-of-the art-testing equipment, and old-fashioned, educated hunches (see sidebar).

After visual and microscopic examination, and depending on the suspected pest, clinic scientists may use a range of diagnostic methods, including traditional plating on selective media — and/or a moist chamber to "grow out" the pest, and standard laboratory ELISA (enzyme-linked immunosorbent assay), PCR (polymerase chain reaction) and biochemical identification methods.

The clinic also has access to DNA sequencing and DNA multi-scan equipment of the Agriculture and Food Laboratory. Under this modern methodology, membranes containing DNA probes can quickly and accurately match a small sample of genetic material from a pest. When abiotic factors are suspected as the source of the plant disease (rather than biological pests), the AFL's Soil Nutrient Lab — also located within the Agriculture and Food Laboratory — can analyze the plants and soil.

With its on-campus location, the clinic can consult with plant disease experts in U of G's School of Environmental Sciences and with Barcode of Life



Oomycete (*Phytophthora capsici*) phytophthora blight of pepper

Necrotic spot virus (no identification for viruses) on impatiens

Gray mold (*Botrytis cinerea*) on Douglas fir

colleagues at the Centre for Biodiversity Genomics. They also work on field samples flagged by specialists in the Agriculture Development Branch of the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA).

Staff at the clinic and in the AFL have developed new diagnostic tests — for example, for boxwood blight, cucumber wilt and tomato bacterial canker. All tests must be validated before they can be used, and staff must adhere to quality assurance protocols of the Standards Council of Canada.

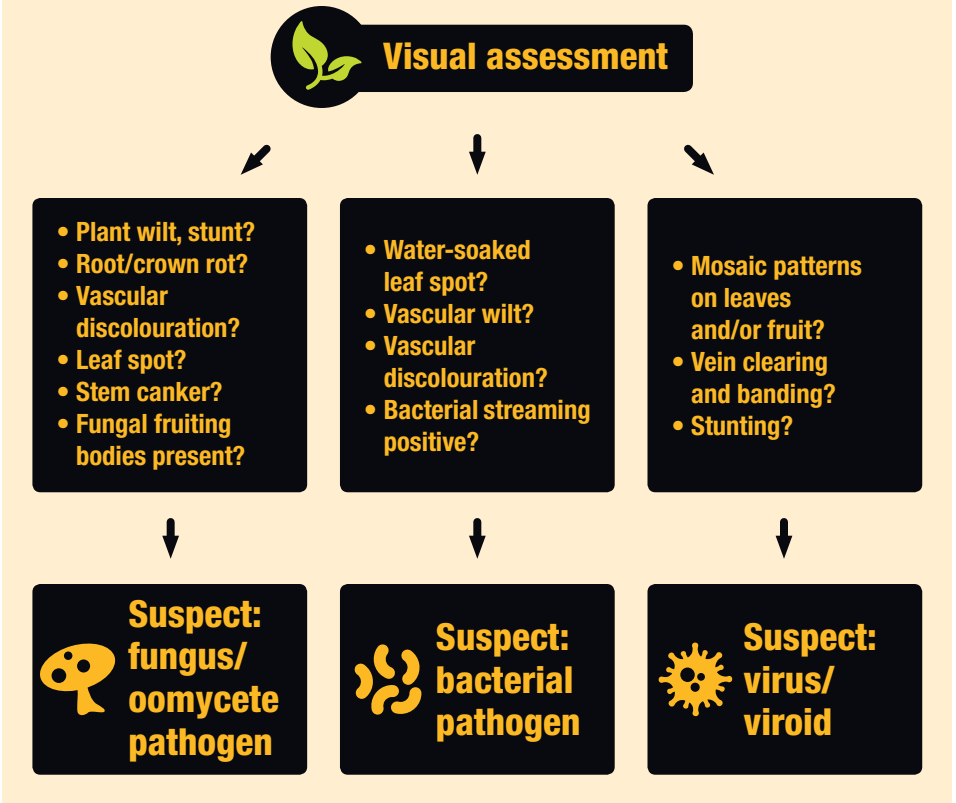
In 2017, Plant Disease Clinic staff worked with OMAFRA to develop and optimize testing methods for detection of:

- tomato bacterial spot caused by *Xanthomonas* spp. on greenhouse hard surfaces;
- *Aphanomyces cochloides* in sugar beets; and
- downy mildew systemic infection in hops, hop latent virus, hop stunt viroid and hop mosaic virus.

In addition to providing an important service to industry, public and government, the clinic serves as a link to the Canadian Food Inspection Agency, which looks after quarantines and programs to prevent invasive species and disease. For more information about the Agriculture and Food Laboratory or the Plant Disease Clinic, go to afl.uoguelph.ca.

The Agriculture and Food Laboratory receives funding from the OMAFRA-U of G Agreement.

First steps to diagnosing plant pests



Photos: Melanie Melzer

In 2016, Ontario exported about $1.8-billion worth of animals and animal products, an important contributor to the provincial economy.

Spotting erysipelas in swine

In spring 2017, the OAHN swine network noted that confirmed cases of erysipelas in Ontario pigs had increased over the previous three quarters. Erysipelas is caused by a bacterium that produces septicemia and chronic lesions in pigs. It can also affect other species such as sheep and turkeys, as well as humans. Several types of vaccines are available and routinely used in swine to prevent the disease, but during that time period, a supply shortage of one of the vaccines may have contributed to increased incidence of the disease.

The OAHN swine network identified this trend in erysipelas from various information sources including Animal Health Laboratory results, private-sector lab data provincial swine condemnation data, and quarterly surveys of veterinarians. The network communicated its findings to the Ontario swine industry and encouraged producers to work with their vets to develop a treatment and/or a vaccination plan that would prevent future outbreaks of the disease.

Ontario's animal health network:

Disease surveillance in action

The University of Guelph's Animal Health Laboratory (AHL) is a large, fully accredited diagnostic facility funded through the OMAFRA-U of G Agreement. Each year the AHL receives about 70,000 animal health cases and performs more than one million tests. It's an essential service for Ontario's livestock industry and for public health, as many new infectious diseases have an animal component in their life cycle.

One of the AHL's most significant roles is disease surveillance of Ontario's livestock and poultry. Although difficult to measure directly, one indicator of the value of this service is the dollar value of animal products exported for sale, since access to foreign markets is based largely on product safety and quality. In 2016, Ontario exported about $1.8-billion worth of animals and animal products, an important contributor to the provincial economy.

Sharing intelligence with industry and government

As part of the province's animal disease surveillance plan, the AHL coordinates the Ontario Animal Health Network (OAHN). Popularly called a "network of networks," the OAHN consists of 10 groups or "networks" of animal specialists, one for each of the major livestock species in Ontario, plus

Quick containment of poultry bronchitis

In 2016, a new strain of infectious bronchitis virus emerged in Ontario poultry. It had already been seen in broiler breeder flocks, but the OAHN poultry network of veterinarians and other industry specialists confirmed that it was now showing up in layer flocks. The network was able to determine the dynamics of the infection by combining OMAFRA's premises identification data with geographical information systems mapping. The network then provided necessary information about containment and mitigation to producers and veterinarians in targeted areas of the province.

Each year the AHL receives about 70,000 animal health cases and performs more than one million tests.

Lyme disease in horses: more likely than expected

A 2016 research study by the OAHN equine network yielded some surprising results about the prevalence and distribution of infection by *Borrelia burgdorferi*, which causes Lyme disease in horses and humans, and *Anaplasma phagocytophilum*, another tick-transmitted zoonotic pathogen in Ontario horses. The research was requested by equine vets as Lyme disease is difficult to diagnose in horses (as it is in humans) and can be hard to treat. Lyme disease is a public health concern, given the increasing incidence of confirmed human infections in Ontario.

Equine veterinarians from clinics across the province provided more than 500 blood samples from horses that met the study criteria: more than two years of age, living outdoors more than six hours per day and remaining within the province.

Results showed that 14 per cent of the horses sampled had exposure to *Borrelia burgdorferi*. Six horses tested positive for *Anaplasma phagocytophilum*, a notable observation given that no cases had been confirmed in horses before 2015. Three were infected with both organisms. The greatest percentage of horses infected with *Borrelia* (24 per cent) were in eastern Ontario. Most of the horses (47 per cent) lived outside 24/7 on pasture, especially in summer (tick season).

Equine practitioners were kept informed of the study through quarterly OAHN equine reports and the AHL newsletter, and the findings were presented at the 2017 Ontario Association of Equine Practitioners annual meeting. This study was useful to identify the presence of infected horses and the geographical areas of greatest risk.

one for companion animals and another for wildlife (a potential source of many livestock diseases).

Each of the networks functions slightly differently, depending on the needs of their industry, but their purpose is the same — to communicate regularly and frequently about any potential animal health issues, usually through quarterly conference calls or meetings.

The networks review the latest AHL results, quarterly Ontario veterinarian surveys, sales barn reports and other current sources of animal health information. While maintaining producer confidentiality, the networks use those results to identify trends, risks and needs for action, such as continuing education, research studies, emergency preparations or communications. They also help prioritize funds for disease investigations and provide expertise in disease or welfare incidents. For multi-species diseases such as rabies, discussions take place across networks.

Producers and their industry groups play an important role. Involvement differs by sector, but in each case the industry group is the key voice of producers in Ontario. Each network regularly posts information for producers and veterinarians on the OAHN website, as well as podcasts and social media feeds on Twitter, Facebook and YouTube. That information allows producers and veterinarians to learn about potential livestock health issues and make informed decisions about their animals' care.

Three years after the establishment of OAHN, there is strong evidence it's working effectively. For example, the networks have spotted early emergence of a new strain of infectious bronchitis virus in poultry, an increase in erysipelas infections in swine, a surprising prevalence of Lyme disease in horses and a new zoonotic disease in dogs and wild canids.

The Animal Health Laboratory receives funding from the OMAFRA-U of G Agreement.

Photos: Farm and Food Care Ontario (pig and chicken), Katrina Merkies (horse)

The results of the Ontario farmland survey by Prof. Brady Deaton are accessible online.

Linking farm land values and rental rates

Robyn Meerveld

Farmland is a fundamental input in the production of food, feed and other agricultural products. It's also a key component of wealth for farmers and non-farmer landlords.

Prof. Brady Deaton, Department of Food, Agricultural and Resource Economics, studies land use and land ownership, including farmland, throughout the world. He believes that understanding the value of farmland in Ontario is critical to understanding the province's agricultural systems.

Deaton is particularly interested in the relationship between rental rates (price per hectare) and farmland values in Ontario. Although some information on farmland value is available, it has been difficult to link these values to rental rates, and the data are generally not easy to find.

To address this gap, Deaton developed a survey of farmland values and made the information publicly available online. In 2016 and 2017, with the support of the Ontario Federation of Agriculture, he surveyed more than 2,000 farmers and farm landlords. Results of the survey are posted at bit.do/farmsurvey.

He notes both the limitations of the data (see the site for details) and key observations.

First, rent and land values vary between counties. Land values appear to be generally higher in near-urban areas, partly reflecting the fact that agricultural land is valued for both its present agricultural use and its potential non-agricultural use.

Second, buyers in near urban-areas are often non-farmers.

Third, rent-to-price ratios are low, reflecting current low interest rates and the upward pressure on farmland prices and availability in near-urban areas.

Photo: Owen Roberts

This information is important to a wide range of stakeholders. Farmers and landlords want to understand both the cash rent rate in their area and the price of land. Government and lending institutions are interested in how survey respondents expect the price of farmland to change over the coming year.

In 2017, Deaton presented this survey information to a federal Senate subcommittee looking at farmland ownership issues in Canada. His presentation can be viewed here: bit.do/farmsurveysenate.

Given the dynamic nature of land values and the need for current information, he hopes to repeat the survey annually. He also hopes to increase the quality and usefulness of the data for Ontario's agri-food sector.

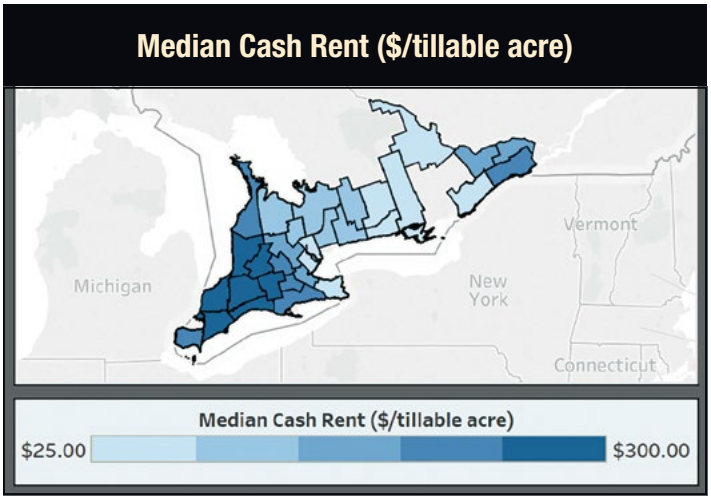
With files from Liz Snyder

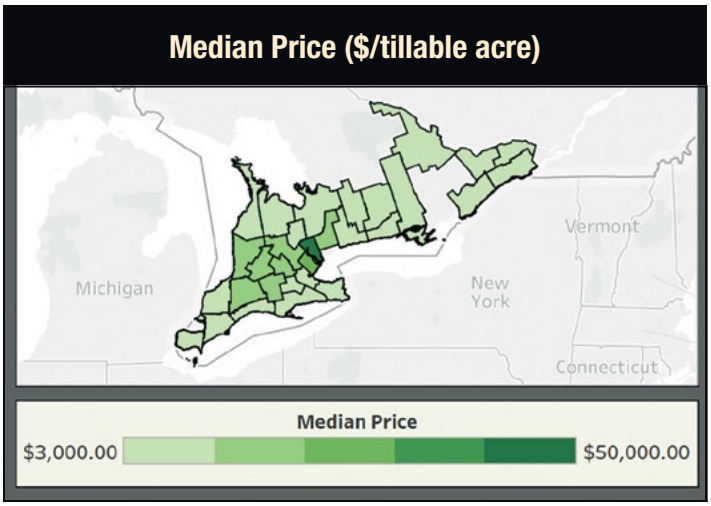
This research is funded by the OMAFRA-U of G Agreement.

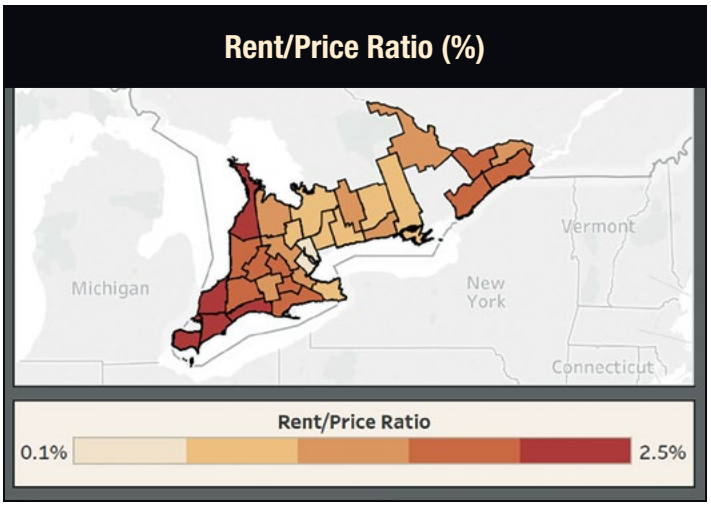
Listen to Prof. Brady Deaton's FARE Talk podcasts at uoguelph.ca/fare/FARE-talk/

By Census Division: Median Cash Rent, Median Price and Rent/Price Ratio

Census Division	Median Cash Rent ($/tillable acre)	Median Price ($/tillable acre)	Rent/Price Ratio (%)
Brant (Census Division)	$200.00	$12,000.00	1.7%
Bruce (County)	$200.00	$8,500.00	2.4%
Chatham-Kent (Census Division)	$250.00	$12,000.00	2.1%
Dufferin (County)	$100.00	$10,000.00	1.0%
Durham (Regional Municipality)	$100.00	$10,200.00	1.0%
Elgin (County)	$250.00	$12,000.00	2.1%
Essex (County)	$200.00	$9,000.00	2.2%
Grey (County)	$100.00	$7,000.00	1.4%
Haldimand-Norfolk (Census Division)	$200.00	$10,000.00	2.0%
Halton (Regional Municipality)	$50.00	$25,000.00	0.2%
Hamilton (Census Division)	$150.00	$12,000.00	1.3%
Hastings (County)	$25.00	$3,000.00	0.8%
Huron (County)	$250.00	$14,600.00	1.7%
Kawarth Lakes (Census Divisions)	$100.00	$7,000.00	1.4%
Lambton (County)	$250.00	$10,000.00	2.5%
Leeds and Grenville (United Counties)	$50.00	$3,000.00	1.6%
Middlesex (County)	$250.00	$14,000.00	1.8%
Niagara (Regional Municipality)	$50.00	$8,100.00	0.6%
Northumberland (County)	$50.00	$4,000.00	1.3%
Ottawa (Census Division)	$150.00	$9,500.00	1.6%
Oxford (County)	$250.00	$20,000.00	1.3%
Peel (Regional Municipality)	$50.00	$50,000.00	0.1%
Perth (County)	$300.00	$18,400.00	1.6%
Peterborough (County)	$50.00	$4,800.00	1.0%
Prescott and Russell (United Counties)	$150.00	$10,000.00	1.5%
Prince Edward (Census Division)	$50.00	$5,000.00	1.0%
Renfrew (County)	$50.00	$4,000.00	1.3%
Simcoe (County)	$100.00	$10,000.00	1.0%
Stormont, Dundas and Glengarry (United Counties)	$200.00	$10,000.00	2.0%
Waterloo (Regional Municipality)	$200.00	$20,000.00	2.0%
Wellington (County)	$150.00	$12,600.00	1.2%
York (Regional Municipality)	$100.00	$15,800.00	0.6%







Graphics: Brady Deaton

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*Based on 2017 ranking by *U.S. News & World Report* of best universities for agricultural sciences
**Based on 2017 ranking by Quacquarelli Symonds of veterinary science programs

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In search of crop diversification

How effective is a cover crop's contribution to soil health?

Janan Shoja Doost

Soil health plays an important role in the success and yield of any crop. But how can soil health be improved using natural methods, and how effective are these proposed methods?

That's what Prof. Claudia Wagner-Riddle and her team in the School of Environmental Sciences (SES) are trying to quantify. They want to understand changes in soil health after introducing rye, brassica, legumes, radish and grass — cover crops that add biomass to soil. Cover crops may use additional water. But adding these cover crops to annual corn-soybean-wheat rotation could improve soil health by building up nutrients.

This is the first such study using lysimeters, which normally measure water flow and nitrate leaching in soil. The U of G researchers are using the devices to determine how diversified crop rotations along with cover crops help soil health.

The researchers hope to help producers grow more grain and improve productivity through use of cover crops.

This research is funded by the OMAFRA-U of G Agreement. Additional funding was provided by the Canada Foundation for Innovation, Grain Farmers of Ontario and the Natural Sciences and Engineering Research Council.

Collaborators include plant agriculture professor Bill Deen and SES professors Kari Dunfield and Aaron Berg, as well as researchers at Western University, University of Toronto, University of Saskatchewan, the Ontario Soil and Crop Improvement Association, Hoskin Scientific and the OMAFRA soil group.

A lysimeter structure as it appears above ground, and (inset) beneath the surface, at the Elora Research Station.

Photos: Cort Egan

Agricultural fields are one of the many types of land found in the monarch migratory range.

Tracking monarch butterfly health

Researchers will monitor migration using tiny radio transmitters

Marika Li

Monarch butterfly populations are declining drastically — losses can be up to 95 per cent in their migratory range. Researchers suspect falling populations are linked to agricultural pesticide use, among other factors such as loss of habitat.

Monarch butterflies are an iconic North American species, known for their pollination services and spectacular annual migrations across the continent. Agricultural fields are one of the many types of land found in the monarch migratory range. The areas surrounding fields may contain milkweed. These areas offer optimal habitat for monarchs. Larvae hatch and feed exclusively on milkweed.

A team of U of G researchers, led by integrative biology professors Amy Newman and Ryan Norris, hope to determine the influence of commonly used insecticides on monarch migration and life cycles to develop habitat conservation practices without incurring crop losses.

"One main goal of the project is to increase milkweed presence in agricultural lands, such as fallow lands or field margins, that won't negatively impact yield," says Alana Wilcox, a PhD student working with Newman.

Over two years, Newman and her team will study the effect of clothianidin, a neonicotinoid used in seed coatings and foliage sprays. Clothianidin, like other neonics, targets the central nervous system of insects, which could affect the development and behaviour of monarch butterflies.

Researchers will look at sublethal effects — negative effects in individuals that survive pesticide exposure — on such activities as migration, mate-finding and reproductive output in butterflies exposed to clothianidin. They will also compare activity in exposed and unexposed butterflies.

Researchers will release some butterflies in Guelph-Wellington and track their migration using tiny radio transmitters and a series of towers.

This research is funded by the OMAFRA-U of G Agreement. Additional funding was provided by the Natural Sciences and Engineering Research Council and Environment and Climate Change Canada.

Photo: Rachael Derbyshire

Keeping Nutrients On-Farm

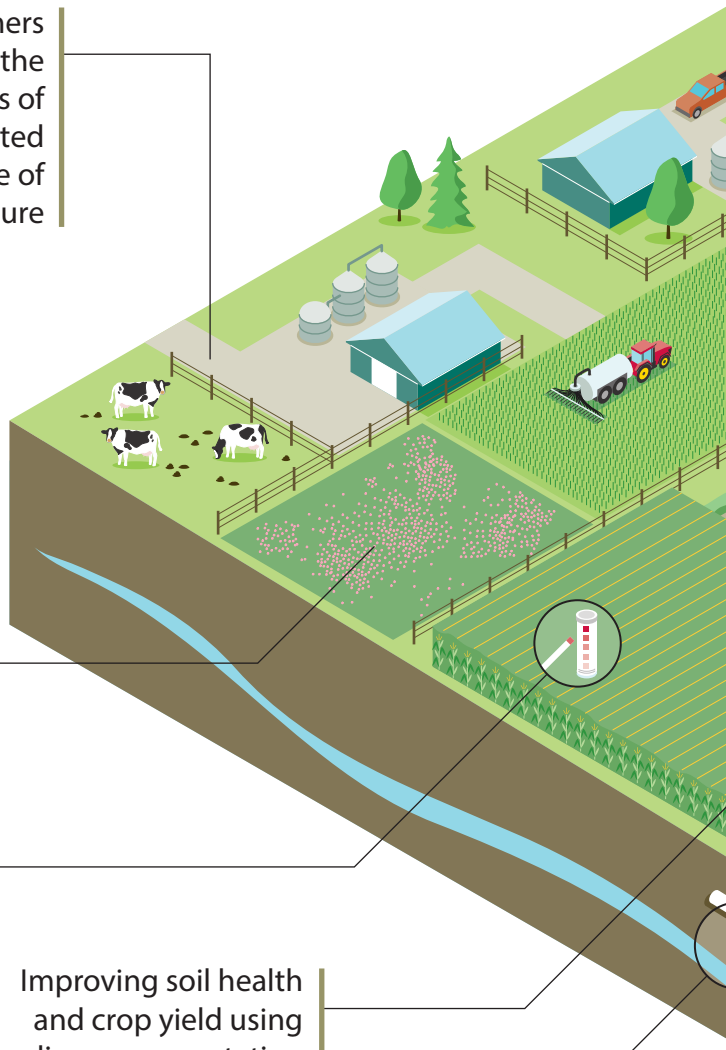
A farm-scale view of environmental

Nutrients such as phosphorus and nitrogen are key to crop health and productivity. But if allowed to move, nutrients can travel off-farm, reduce water quality and increase costs for farmers.

The OMAFRA-U of G Agreement helps keep nutrients on-farm by supporting research that advances our understanding of the nutrient transport system – from application and retention to transportation and mitigation – and by developing evidence-informed best management practices, tools, and technologies.

Increasing environmental awareness: Research to increase farmers' participation in the Environmental Farm Plan (EFP)

Evidence to help farmers on-farm: Comparing the benefits and costs of anaerobically digested manure to those of raw manure



Optimizing fertilizer use by studying red clover growth

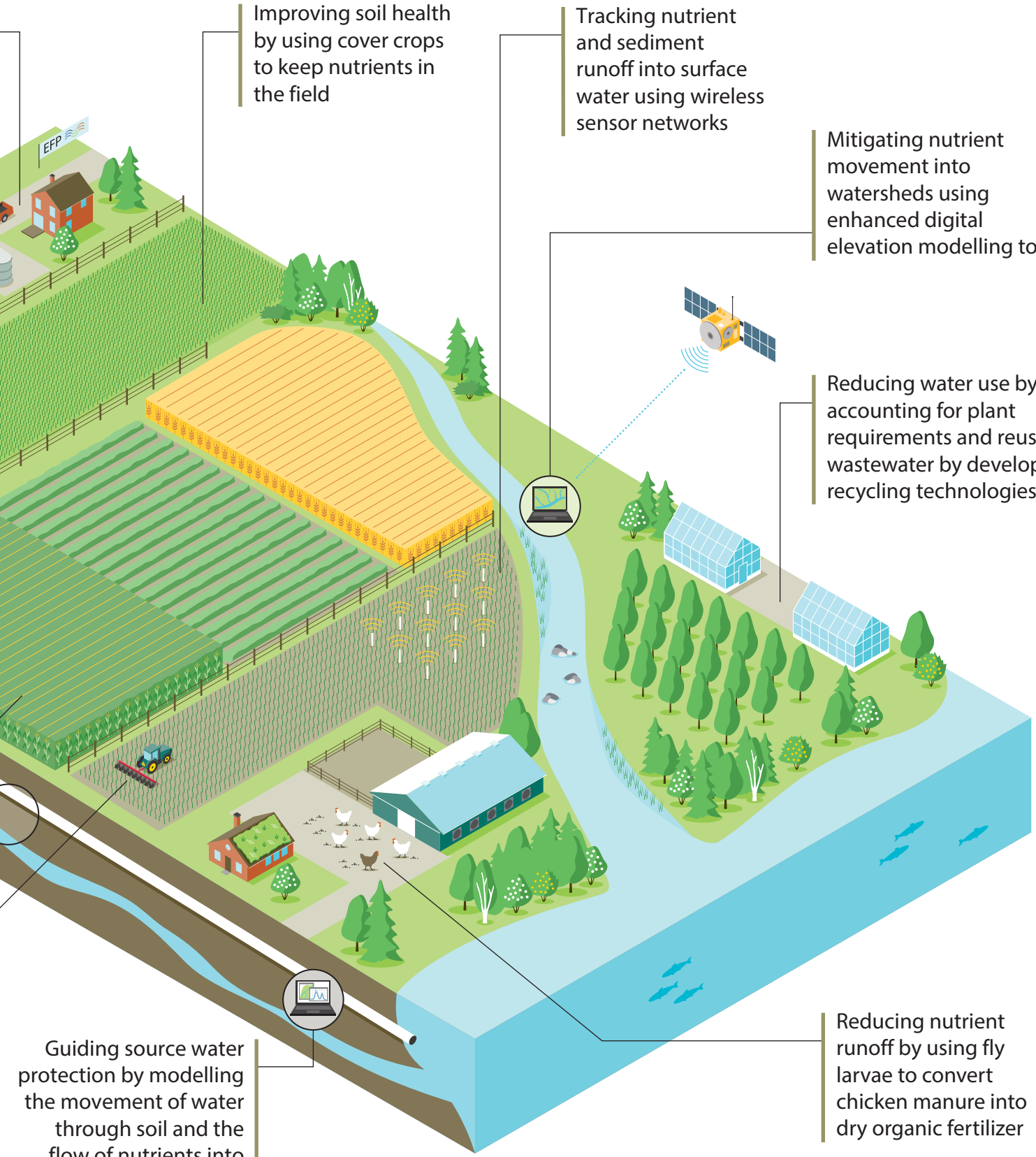
Optimizing fertilizer and pesticide use by developing a new nitrogen test and biopesticide

Improving soil health and crop yield using diverse crop rotation

Reducing nutrient transport through soil by identifying areas at risk of groundwater contamination

Reducing soil phosphorus loss by evaluating the effectiveness of best management practices

sustainability research supported through the OMAFRA – U of G Agreement.



Building consumer trust — one search at a time

Researchers look to create practical communications recommendations for the ag supply chain

Study participants were randomly assigned to one of four survey treatments, focusing on a hypothetical biotech product called the Always Green Avocado.

Joey Sabljic

Say there's a new type of vegetable about to hit the market — one that's been genetically modified with superior consumer traits, perhaps to prevent spoilage.

For consumers, is this a biotech breakthrough that will reduce food waste...or something dangerous and unnatural?

A University of Guelph researcher says a better understanding of how consumers search for and access information about biotechnology and modern agriculture could be key in helping the ag industry communicate the value of new technology while also building trust.

Prof. Andreas Boecker, Department of Food, Agricultural and Resource Economics (FARE), and Alexandra Grygorczyk, a researcher at Vineland Research and Innovation Centre in Vineland, Ont., and a U of G adjunct professor, say the intense public debate around biotechnology demands new ways of connecting with consumers.

"What we've typically seen in communications is a focus on the science, research and safety behind a new agricultural technology or product," says Boecker. "And while those are important messages, there still needs to be a greater emphasis on understanding the public's concerns or communicating about topics that are relevant to them."

This, he says, is where shared values statements and language could help the ag industry find more common ground with consumers.

For example, a typical shared values statement might open with a phrase like: *We understand that environmental protection is important to you, so here's how this new technology can help*. Or: *When it comes to food, we acknowledge the need for a transparent process*.

"Shared values communications are about the

Photo: iStock.com/mludzen

industry and consumers working towards a common goal together," says Boecker.

The researchers also wanted to dig deeper into how web search results affect the ways consumers search and select information on the Internet.

Boecker says a web search for a subject on biotechnology like GMO foods typically yields a single list of search results with mingled pro- and anti-GMO perspectives.

How search results are presented can lead to what's called confirmation bias among consumers — that is, the human tendency to search for information that confirms what we already believe.

For example, if someone favouring agricultural biotechnology searches the web for articles on that topic, they may be more likely to click on links to information sources expected to have similar views, and vice versa.

Boecker and Grygorczyk wanted to see whether juxtaposing contrasting biotechnology articles would lessen consumers' confirmation bias.

They designed and administered an online survey with 500 participants to test their hypothesis about contrasting information presentation and shared values statements. The survey focused on a hypothetical biotech product called the Always Green Avocado.

For example, one article emphasized the stringent approval process for bringing an avocado to market, while a contrasting article criticized that process for not requiring additional independent testing.

"We wanted to know whether having links to articles with contrasting perspectives on a GMO topic side by side would make them more likely to look at both sides of the argument," says Boecker.

After drawing out the participants' general attitudes and beliefs about science and technology and natural products, the researchers led participants through a simulated online search about the new food product.

Participants were randomly assigned to one of four survey treatments: Contrasting information presented with and without shared values statements, as well as non-contrasting information presented with and without shared values statements.

Boecker and Grygorczyk found that in the two survey treatments with contrasting information presentation, participants showed less confirmation bias.

"Overall, across all four survey treatments, participants selected the articles that were critical about the new product more often. However, participants in the survey treatments with contrasting information presentation were much closer to an even selection of articles on the pro and contra side about the Always Green Avocado," says Boecker.

Next, the researchers hope to better understand whether contrasting information would have different effects on survey participants who indicated that they were for or against biotechnology or who were undecided.

"If we look at the three groups separately, we might find three sets of results, which would give us a better understanding of how the contrasting information effect works," says Boecker. "The contrasting format has helped to balance the information selection — which is the first step in possibly helping people see diversity of agriculture in a different way."

The researchers saw no impact in the shared values statements, although Boecker says incorporating those statements into more communications may need a longer time to sink in with consumers.

After analyzing the survey results, Boecker and Grygorczyk hope to produce a practical "how-to" guide to help members throughout the agricultural value chain engage with the public more effectively.

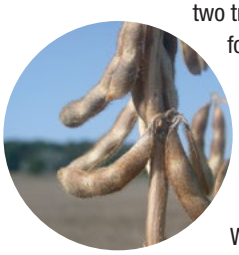
This study is based on thesis work by Lana Pribic, an M.Sc. graduate in Food, Agricultural and Resource Economics.

This research is funded by the OMAFRA-U of G Agreement.

New high-yielding soybean contains more beneficial oil

A new high-yielding soybean variety offers new opportunities for Ontario manufacturers to use its oil for industrial applications such as coatings, paints and auto parts.

Prof. Istvan Rajcan, Department of Plant Agriculture, says the new variety contains one-third more linoleic acid than in commodity soybean oil and 12 per cent more fatty acid double bonds. Both components improve processing to make industrial products.



"High yields and double bonds are two traits that are beneficial for efficient production in manufacturing industrial materials," says Rajcan.

Rajcan crossed his high-yielding OAC Wallace soybean with the RG25 variety developed by the late plant agriculture professor Gary Ablett.

The new variety (OAC 13-55C-HL) produced 10 to 15 per cent more soybeans than Ablett's variety, containing a comparable amount of linoleic acid – nearly 70 per cent – to that of RG25.

Rajcan produced 200 kilograms of the new oilseed variety with help from Guelph-based Oilseed Innovation Partners (OIP), formerly known as SOY 20/20.

He and his team are now determining how much more income a farmer might receive as a premium for growing these soybeans.

– Shannon Mustard

This research is funded by the Oilseed Innovation Partners and U of G's Research Innovation Office, and builds on foundational soybean research funded by the OMAFRA-U of G Agreement.

Growing Asian flowers for Ontario markets

Flowers are important in cultural and daily activities for many Asian immigrants, including South Asians, who by 2050 will make up one-third of the Greater Toronto Area (GTA) population. But Asian plants are mostly unavailable in Canada, meaning immigrants have few opportunities to reconnect with flowers from their home countries.

Alexandra Grygorczyk, a researcher at the Vineland Research and Innovation Centre in Vineland, Ont., and a U of G adjunct professor, leads a research team that is helping to bring *Jasmine sambac*, commonly known as Arabian jasmine, to Canada. Introduced to Longo's markets in the GTA in 2017, the plants will become more widely available this year.

Jasmine is significant in Asian cultures, especially for many followers of Hinduism and Buddhism. The plant can grow in Canadian greenhouse conditions. Jasmine plants consist of leafy green vines and small white flowers that give off a heady sweet scent.

"The key thing about jasmine flowers is their fragrance, not their look," Grygorczyk says. "Jasmine flowers don't look like the big colourful flowers commonly sold here."

"The key thing about jasmine flowers is their fragrance, not their look. Jasmine flowers don't look like the big colourful flowers commonly sold here."

Grygorczyk expects that growing jasmine in Ontario will also benefit local floriculture markets. Ontario growers face competition from growers in warmer countries who cultivate cut flowers outdoors. Jasmine will be sold as a potted plant and can be grown in Ontario greenhouses in the summer when many floriculture greenhouses operate below capacity.

Jasmine is one of a number of plants selected by researchers after a supply chain analysis, focus groups and country-wide consumer surveys. After completing jasmine production trials at Vineland and Westbrook Greenhouses Ltd., Grygorczyk and her team hope to introduce more Asian plants to Ontario.

– Marika Li

This research is funded by the OMAFRA-U of G Agreement. Additional funding was provided by Longo Brothers Fruit Markets Inc.

From lab bench to consumer products

Spin-off company builds facility to mass-produce PhytoSpherix

Alyssa Logan and Owen Roberts

A decade ago, Anton Korenevski, a researcher in Prof. John Dutcher's physics lab, was performing a complicated chemical procedure when he realized the waste material from the exercise looked peculiar.

Normally, such waste would be discarded. But this time, Korenevski decided to hang on to it and do further analysis.

That turned out to be a fortuitous decision. That so-called waste turned out to contain a unique sugar polymer molecule — since named PhytoSpherix — with incredibly broad applications. The molecules are produced in some varieties of sweet corn and have the distinct advantage of being completely natural, and even edible.

"One of the most remarkable abilities of these particles is how they retain moisture," says Dutcher.

Today, PhytoSpherix is on track to be used for food, age-defying super-moisturizers and non-toxic drug treatments. This summer, Mirexus, the spinoff company created to commercialize PhytoSpherix, will open a 12,000-square-foot R&D and manufacturing facility in Guelph's industrial park, with its staff expected to grow to 72 full-time positions within the next 10 years.

PhytoSpherix has a bright future, says Dutcher. It has applications as a non-toxic, biodegradable replacement for certain engineered nanoparticles and petroleum ingredients. He says it can make products such as cosmetics and biomedical treatments more environmentally friendly and more effective.

This research is funded by the OMAFRA-U of G Agreement. Additional funding was provided by Gryphon's LAAIR, GreenCentre Canada and Innovation Guelph.

Photos: Chevonne Carlow (OMAFRA, left), Martin Schwalbe (opposite)

U of G physics professor John Dutcher (centre) is flanked by his lab members while holding a flask of PhytoSpherix solution, outside an R&D and manufacturing facility being built in Guelph. The new plant will process and produce PhytoSpherix, a versatile sweet corn-based molecule discovered in Dutcher's lab.

Mental health, psychology... and agriculture

A groundbreaking study is launched to help farmers handle stress, depression and isolation

| Owen Roberts and Liz Snyder

Although we live in an era of so-called fake news and doubts about some information's authenticity, no one calls into question a social media post from a farmer that says "farm stress is real. Suicide is real."

Posts like that set alarm bells ringing for population medicine Prof. Andria Jones-Bitton of the Ontario Veterinary College (OVC). Through her research dealing with veterinarians' mental health challenges, she has found farmers face similar issues such as isolation, stress and depression. But due to the stoic nature of farming, these food producers have traditionally said little, at least publicly, about their struggle.

However, it looks like what they needed was a safe outlet to express their concerns. And that's what they found in 2015, when Jones-Bitton launched an online survey to try to get farmers to open up about the problem. Indeed, more than 1,100 farmers completed it, noting how they were dealing with mental health problems by themselves...but not very successfully.

"Some of the producer comments left little doubt about the impact their job and their environment is having on them," she says. "One said, 'We are not invincible, but we feel we must be'. Another said, 'What makes me the most upset is that I have everything I dreamed of — love, family and a farm — and all I feel is overwhelmed, out of control and sad.' We can do better by our producers."

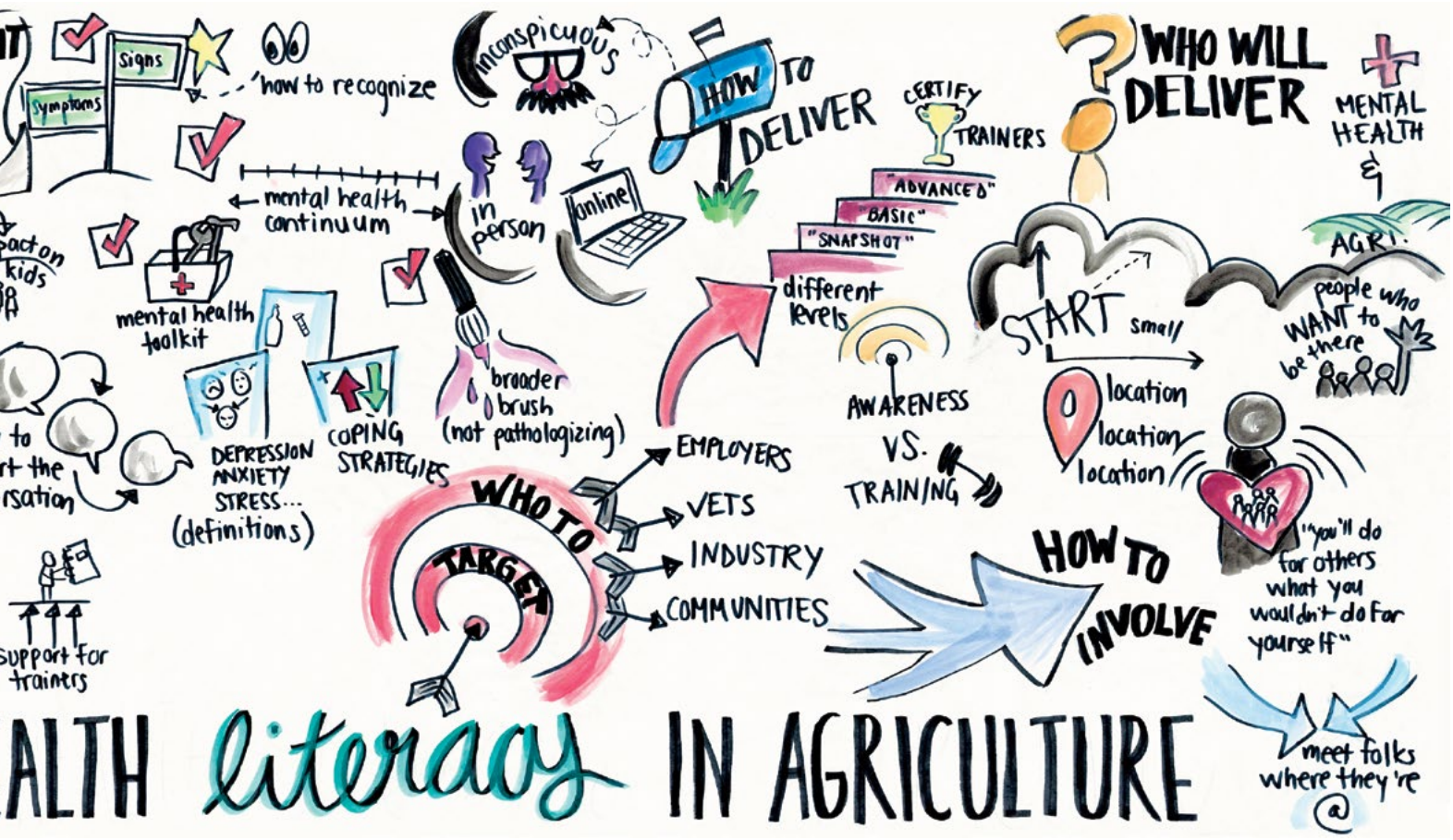
So she and her team are now immersed in a multi-pronged approach to farmers' mental health.

First, PhD candidate Briana Hagen and DVM student Ashley Albright are engaged in a comprehensive review of farmer mental health research, and of the few delivery programs and resources that have already been developed for farmers in Canada and abroad. They looked for factors that contributed to these programs either succeeding or not succeeding.

In many cases, it seemed to be the availability of resources was key.

"In some cases, programs have been initiated in response to a very specific crisis — like an animal disease outbreak, for example — and when the outbreak dies down, so does the support," says Jones-Bitton. "There are helplines that have been in place that are dependent on soft dollars or volunteer support, and so unfortunately they went the way that a lot of those things go."

Hagen has also conducted hour-long interviews with farmers across Ontario, to determine their specific needs. The interviews covered the stresses farmers experience in their day-to-day work as well as times of serious crisis — like animal disease out-



"The dream down the road is to develop national resources for our producers."
—Prof. Andria Jones-Bitton

breaks or barn fires.

The farmers were asked how they think farming impacts their mental health. If they experienced mental health issues in the past, they were asked how it influenced them, their families, their livestock (if applicable) and their business.

They were also asked whether or not they sought help, and if they did, how they found that experience for them.

Jones-Bitton saw from the initial survey that farming can be a socially isolating occupation, so they also interviewed government, veterinarians and industry — those are the people that farmers are most often in contact with, and may be the ones who can see signs that things just aren't right.

There was overwhelming support for developing a mental health literacy program for agriculture. Mental health literacy means being able to recognize and talk about the signs of stress, depression and other mental health struggles — and most importantly, being able to encourage someone struggling to get support.

She also assembled a working group of veterinarians, farmers, government, industry, social workers, psychologists, adult educators and academics to talk about developing a mental health literacy in agriculture program. They will be piloting the program they developed this summer.

Stigma around mental illness and access to mental health programs are especially challenging in farming communities. For a program to be successful, Jones-Bitton says it will need to be grounded not only in mental health and psychology but also in agriculture.

Ultimately, she will use the information revealed through her research to determine what resources are needed for sustainable support for farmers right across the country.

"While a lot of our work is Ontario-focused, we are speaking with interested people and collaborators in other provinces as well," she says. "The dream down the road is to develop national resources for our producers."

This research is funded by the OMAFRA-U of G Agreement. Funding is also provided by Egg Farmers of Ontario, Ontario Pork, Ontario Sheep Marketing Agency, Ontario Federation of Agriculture and the Canadian Animal Health Coalition.

Graphic: Alexandra Sawatzky

The state-of-the-art Livestock Research and Innovation Centre – Dairy Facility at Elora supports studies that help shed light on industry challenges.

Innovative technology streamlines ketosis research and prevention

Dairy cows are like marathon runners. Making milk at peak production is said to take as much energy as a human running two marathon races per day.

As with high-performance athletes, that demand puts stress on cows' bodies. And that can lead to a common but hard-to-detect condition called ketosis that shows no outward illness.

"If you walked into a barn and there were 100 cows standing around you, you couldn't tell by looking which cows have ketosis." —Prof. Stephen LeBlanc

"Ketosis in cows is clinically very subtle," says Prof. Stephen LeBlanc, Department of Population Medicine. "If you walked into a barn and there were 100 cows standing around you, you couldn't tell by looking which cows have ketosis."

University of Guelph researchers are working to improve the efficiency of ketosis diagnosis, prevention and treatment. It increases the risks of other diseases, premature culling, reduced milk production and fertility. More than 40 per cent of cows experience ketosis at least once per lactation, which costs producers around $300 per affected cow. The accumulated economic burden is substantial.

Using automated systems such as DeLaval's Herd Navigator to reduce labour in testing milk samples for ketosis and measuring production, LeBlanc and his team determined that the optimal testing frequency for ketosis in cows was three to four times a week, to avoid missing any affected cows.

The next question is whether it's more beneficial to act immediately and treat at the first detection of ketosis, or to wait and see whether ketosis persists for a few days.

"We're still looking to optimize therapy," says LeBlanc. "Existing therapies have cure rates of about 75 per cent for ketosis, but one-quarter of cows still have persistent ketosis. One thing that we're looking at is what we can do better to drive that success rate up."

– Karen K. Tran

Population medicine researchers on these projects include Prof. Todd Duffield, PhD graduate and former post-doctoral scholar Khaled Gohary, and M.Sc. student Maggie Williamson.

This research is funded by the OMAFRA-U of G Agreement. Additional funding was provided by DeLaval, Mitacs and CanWest DHI.

Cost of ketosis per affected cow

40% of cows experience ketosis at least once per lactation

25% of cows have persistent ketosis, even after therapy

Photo: Livestock Research Innovation Centre

The brown marmorated stink bug is a top-priority pest. The insect is pictured here in its nymphal stage.

Invasive insect pest evades traditional control methods

Shannon Mustard

When it comes to emerging insect threats, the brown marmorated stink bug (BMSB) is a top-priority pest for researchers and farmers. It devastates crops such as apples and grapes, and it's proving to be difficult to control.

"We will have to be creative with our ideas, because we are unable to rely on the traditional ways growers have controlled insect pests in the past." —Prof. Cynthia Scott-Dupree

"We will have to be creative with our ideas, because we are unable to rely on the traditional ways growers have controlled insect pests in the past," says Prof. Cynthia Scott-Dupree, School of Environmental Sciences and holder of the Bayer Chair in Sustainable Pest Management.

Scott-Dupree has studied the insect since 2012, shortly after the first outbreak was recorded in Hamilton, Ontario. Calls for assistance came into insect identification and control hotlines at the Ontario Ministry of Food, Agriculture and Rural Affairs (OMAFRA) from people whose homes had been invaded by the creatures.

Along with her OMAFRA and Agriculture and Agri-Food Canada colleagues, and graduate students, Scott-Dupree began scouting residential neighbourhoods and farmland. Those are hot spots where she hoped to locate the bug.

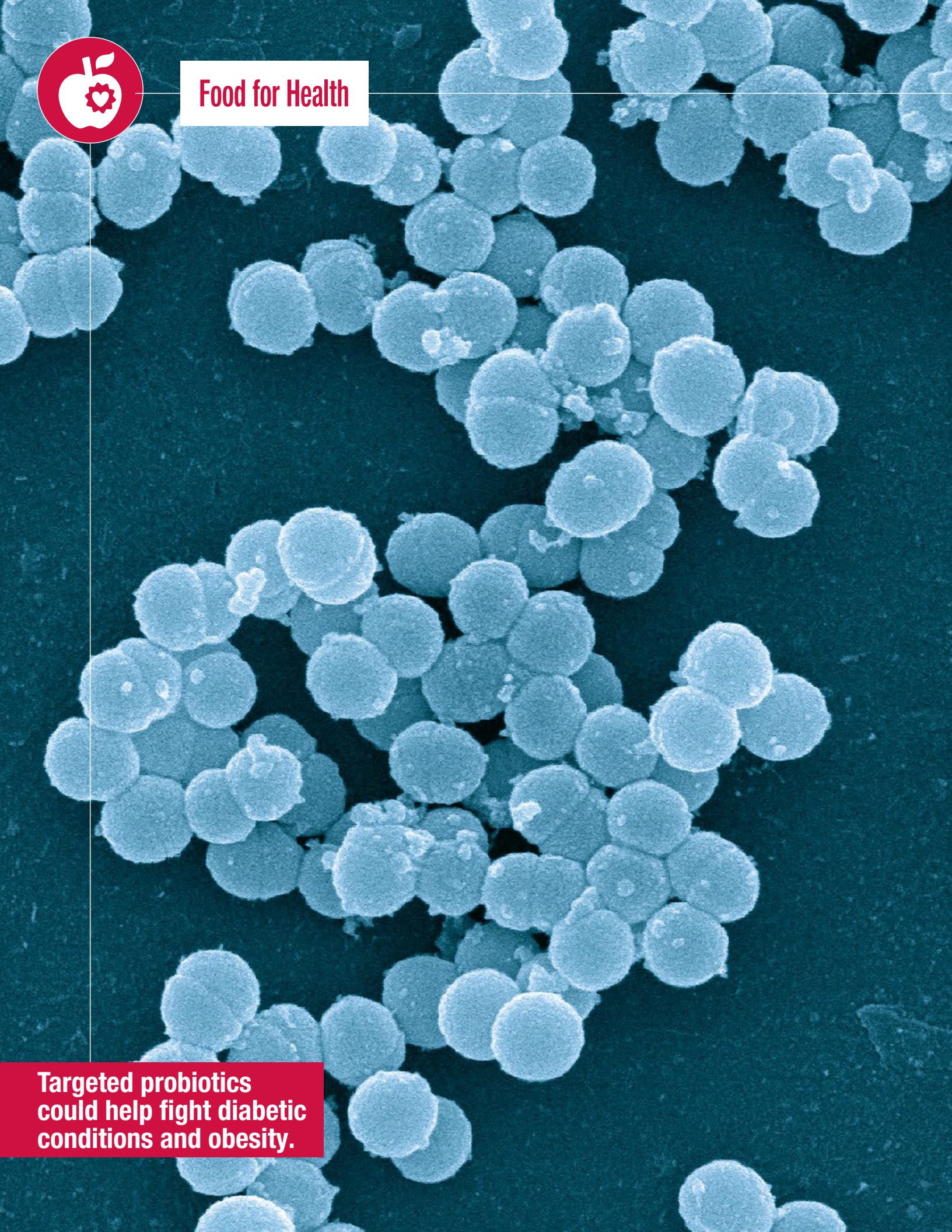
BMSB is a problem year-round. In fall and winter, it moves from fields into house attics. In spring, the bug disperses into farmers' fields and nearby hedgerows.

The researchers have focused on finding an effective pesticide for nymphs, or the immature stage of the insect. Without such a treatment, growers must look for novel controls to manage the insect.

"The BMSB nymphs move in a leapfrog pattern continuously in and out of the fields because they may not receive all the nutrients they need from one location," says Scott-Dupree. That behaviour makes it challenging to effectively apply controls or insecticides to the infested portion of the field.

This research is funded by the OMAFRA-U of G Agreement. Additional funding was provided by Grain Farmers of Ontario, Ontario Apple Growers, Grape Growers of Ontario, Ontario Tender Fruit Growers' Association, Bayer CropScience, Valent and Dow AgroSciences.

Photo: Hannah Fraser



Targeted probiotics could help fight diabetic conditions and obesity.

Bacteria need good food, too

Researchers work to load up grain-based commodities for better overall health

Overall health relies on the proper functioning of "good" gut bacteria that help boost immunity, digestion and infection resistance.

These bacteria, called probiotics, feed on prebiotics, which are mostly starches and sugars that promote the growth of these beneficial microorganisms. Researchers are now investigating the prebiotic potential of grains such as quinoa for optimal probiotic functioning.

Some prebiotics increase probiotic populations more quickly than others, leading to healthier gut bacteria.

A research team led by Prof. Cezar Khursigara, Department of Molecular and Cellular Biology (MCB), is investigating interactions between probiotic species, and looking at which prebiotics yield the most gut bacteria to target specific health conditions and diseases.

"In addition to potential therapeutic applications, we have an opportunity to combine basic and applied research to help improve lives," says Khursigara.

He says some of the targeted probiotics could also help fight diabetic conditions and obesity.

"Examining the interactions between pre- and probiotics can ultimately help optimize human health."

– Janan Shoja Doost

Collaborators on this project include MCB professor Emma Allen-Vercoe.

This research is funded by the OMAFRA-U of G Agreement.

Half oil, half gel: oleogels take the place of trans- and saturated fats

Excess trans fats and saturated fats can harm your health—they increase the possibility of a stroke, heart disease or diabetes. Trans fat will not only increase the harmful cholesterol in your body, but it also decreases the amount of beneficial cholesterol.

University of Guelph researchers have been at the forefront of trans fats research for decades. Nutritional sciences professor Bruce Holub was one of the first in the world to describe their harmful effects.

But replacing trans fats and saturated fats is difficult—they play an important role in the texture of food products and cannot be easily replaced by liquid oils.

That's where oleogels—a mix between an oil and a gel—come in. Prof. Alejandro Marangoni, Department of Food Science, has found ethylcellulose-structured oleogels help maintain the texture and quality of food products while avoiding the addition of excess fats.

He and meat scientist Shai Barbut created models, as well as finished food products of liver paté, frankfurters, salami, processed cheese and croissants, to study and contrast the properties of fat in the actual food product.

They were able to replace the hard fats found in all these foods and had the most success with processed meat.

Next, Marangoni plans to work out ways to scale up the oleogels into commercial foods. He is seeking industrial partners to make a business case for this initiative.

– Shannon Mustard

This research is funded by the OMAFRA-U of G Agreement.

Prof. Alejandro Marangoni made these cookies in the Department of Food Science product development kitchen, with oleogels rather than traditional fats… and he reports they taste as good as they look.

Photos: Cezar Khursigara (opposite), Alejandro Marangoni (right)

Nutritious food is important to the Peeters family, who are participating in the Guelph Family Health Study.

Starting early for better health

First Canadian study of its kind focuses on families

Behaviours that children develop before age five can result in lifelong health habits. And over the past decade, those behaviours have been getting worse.

That's what led Guelph researchers to create the Guelph Family Health Study, the first Canadian study of its kind engaging community partners and families. The 20-year study is intended to learn whether early life interventions can lead to sustained behaviour change and less illness later in life.

This innovative study starts early in life, gives parents health information for family members, and explores how behaviour change improves biological responses linked to obesity and chronic disease risk.

In this integrated knowledge transition model, participants are active members and decision-makers. A council consisting of 15 parents meets three times a year to provide feedback on methods, study approaches and information awareness.

—Megan Swim

This research is funded by the OMAFRA-U of G Agreement. Additional funding is provided by the U of G's Better Planet Project's Health for Life Initative, Canadian Institutes of Health research and Canada Foundation for Innovation.

Toward improved food-preparation skills

A recent Health Canada report identified a need for research that improves cooking and food preparation skills of Canadian families.

That led Angela Wallace, a Guelph Family Health Study project coordinator, to investigate the connection between parental food skills and family members' fruit and vegetable intake. She wondered: Does a parent's food skill level and enjoyment of cooking affect how many fruits and vegetables are consumed by the household?

To test this idea, she has collected food skill surveys, along with food and beverage receipts over a three-week period and three-day food records for parents and children. Data analysis for the study is now underway.

Wallace says that by learning more about Canadian families' food skills, researchers can help them improve their cooking, consume more fruits and vegetables and eat more seasonally.

Photo: Guelph Family Health Study

Improving food choices through the genetics of taste

Parents often have a hard time convincing their children to eat their veggies. Some kids are simply picky eaters, but researchers in the Guelph Family Health Study suspect genetics helps explain why kids avoid certain foods.

Previous studies have shown that humans evolved aversions to bitter foods to avoid eating toxic plants. Over millennia, these genetic taste perceptions have persisted.

Nutritious, leafy green vegetables such as brussels sprouts, cabbage, kale and spinach are the worst offenders for people sensitive to bitter flavours. But if parents understand taste preferences, they can increase their children's fruit and vegetable consumption by preparing meals and snacks in ways that mask unpleasant tastes.

Elie Chamoun, a U of G PhD student working with Prof. David Ma, Department of Human Health and Nutritional Sciences, aims to understand how taste perceptions impact everyday food choices.

Chamoun suspects that genetic sensitivity to bitter foods can lead children to select highly palatable, unhealthy foods.

The Dickin family is participating in the Guelph Family Health Study.

He hopes to determine whether such eating habits are formed early in life.

"Some studies suggest that genetic differences in how we taste bitter, sweet and fat foods may predict some of our eating habits," Chamoun says. "These findings warrant further research because of the risk of developing metabolic diseases from consuming energy-dense foods."

Chamoun has a few tricks for making bitter veggies taste delicious, such as cooking them in olive oil and seasoning them with fragrant herbs and spices. He also recommends blending leafy greens such as spinach into fruit smoothies, which can be made into healthy popsicles for the summer.

While this study is intended to help parents optimize the diet and health of young children, Chamoun believes the research holds broader implications for public health.

"If we determine the genetics of taste to be an important risk factor for developing poor eating habits and chronic diseases, then our knowledge can be applied by health-care providers and dietitians to improve their clients' dietary intake and health outcomes."

—Marika Li

Increasing fruit and vegetable consumption through home visits

Less than 30 per cent of Canadian children get their recommended daily amount of fruits and vegetables. In Guelph, home visits from health educators with the Guelph Family Health Study have increased that rate.

In a pilot study, children who received home visits decreased their body fat by 3½ per cent, increased their daily fruit servings and consumed more fibre than children who did not receive home visits.

Prof. Jess Haines, Department of Family Relations and Applied Nutrition, developed the six-month, home-based intervention. She says the results reflect motivational interviewing, a client-focused counselling style that may help families change lifestyle behaviours through individual experiences, challenges and environment.

During each visit, health educators support families by setting goals and routines for family meal frequency — including fruit and vegetable consumption — and for lifestyle factors such as sleep, physical activity and screen time.

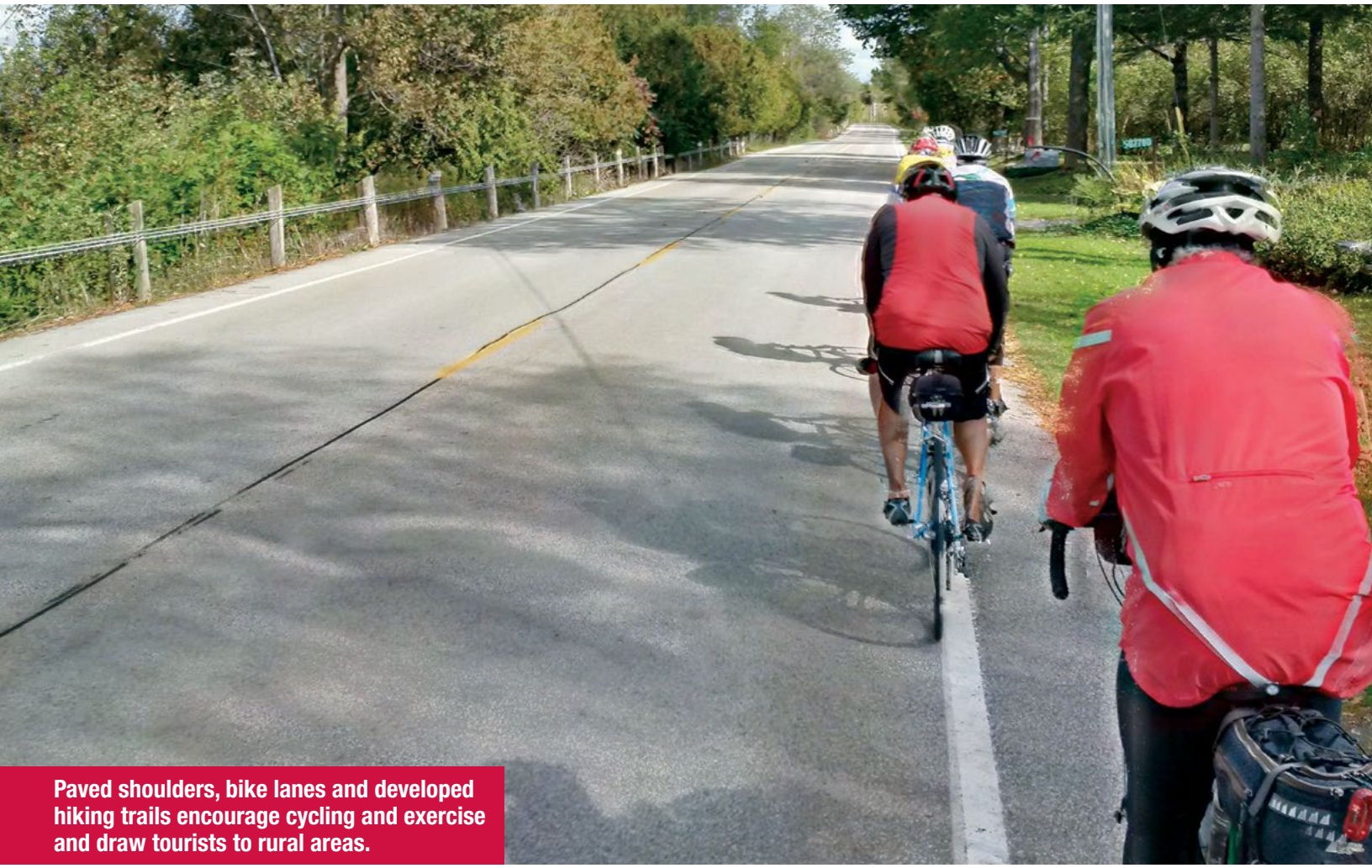
About 30 per cent of Canadian children are overweight or obese.

Besides receiving four home visits, families received emails tailored to their health behaviour goals and incentives to support these behaviours.

Haines is leading a trial of the home-based intervention with 300 families in the Guelph area. Balanced recruitment will help ensure that results translate to families of varying socioeconomic backgrounds.

—Megan Swim

Photo: William Albabish



Paved shoulders, bike lanes and developed hiking trails encourage cycling and exercise and draw tourists to rural areas.

On the road to healthier rural communities

Research team takes best practices tool kit to workshops with rural stakeholders

| Joey Sabljic

Why all the interest in newly paved shoulders on county roads?

For Prof. Wayne Caldwell, School of Environmental Design and Rural Development, paved shoulders encourage cycling and exercise. That means they draw people who like to bike for tourism, as well as people who like to bike to work and might set up businesses in bike-friendly communities. That affects jobs in surrounding rural communities.

And all because of paved shoulders!

Caldwell and his team aim to understand the many interconnecting factors — from bicycle lanes and transportation planning to air quality and affordable housing — that help ensure

Photos courtesy Grey County

the long-term health of Ontario's rural communities and their residents.

"A 'healthy' rural community or population is about far more than one's physical health," he says. "It's also about one's mental health, about one's sense of pride and belonging to a community, about family — all of the things we value so deeply."

He says the built environment in rural communities — including roads, parks and buildings — can pose different challenges from that of urban areas.

Transportation in rural communities often involves a vehicle because of longer distances between destinations and fewer trails, sidewalks and bike lanes. Caldwell's team found that residents here drive more and walk less.

Smaller, spread-out rural populations can mean fewer job opportunities, more

poverty and sparse community resources, such as local grocery stores and parks.

"Changes or factors that might seem insignificant to people living in large urban centres, like the closing of a grocery store, can also have a deep impact on a rural population's health and well-being," he says. "We wanted to bring more attention to issues like poverty, housing and economic development that aren't always that obvious when you look at rural areas."

That's what led his team — with funding from Public Health Ontario — to work with public health units, planners and officials from rural municipalities across the province in creating the Healthy Rural Communities Tool Kit. The guide contains case studies and practical examples of improvements in several key areas, such as access to healthful local food, affordable housing, economic development, and parks and gardens.

Caldwell says this practical guide can help rural planners, public health staff and policy-makers to create healthier communities and, in turn, healthier populations.

Taking their tool kit on the road

Over the past year, the U of G researchers took the tool kit to five counties and municipalities to share research and best practices, and to hear success stories from the communities.

In half-day workshops, they brought together public health staff, municipal planners, elected officials and members of the public to share creative approaches in such areas as active transportation plans, access to recreational programming and food literacy programs.

For Caldwell, the workshops were not about highlighting resources or programs lacking in each rural community but about creating awareness of what's being done — and what's still possible.

"When given the opportunity to start talking about the good things that are happening in their communities, there's no end to examples that are positive, constructive and speak to a very optimistic future. It's a matter of celebrating and recognizing those accomplishments."

Scott Taylor, a senior planner with the Grey County planning department, met staff from other municipal departments, such as parks and recreation, and such agencies as the Canadian Mental Health Association (CMHA) and the Council on Aging.

"Having all those stakeholders at the table shone a light on some initiatives that I wasn't aware of," says Taylor.

His department began discussing parks and green spaces after he learned about a CMHA community garden project in Owen Sound. From the tool kit and from workshop participants in other municipalities, county planners also learned about creating a cyclist- and pedestrian-friendly transportation plan.

Caldwell's presentation on local health indicators for Grey-Bruce was useful for Taylor, who has seen more people moving to Grey County from larger urban areas, such as Toronto.

"There is in some cases this perception that we're healthier than big-city folks, but the research almost points to the opposite — we're driving more, walking less and at greater risk for health issues," Taylor says.

Janet Dawson, a health promoter with Peterborough Public Health, says Caldwell's workshop led to discussions between public health staff and municipal planners in Peterborough County. A new working group has talked about how to promote healthy built environments through land use planning and policies.

The U of G researchers have discussed the tool kit and research findings at conferences for professional planners, parks and recreation staff, and municipal groups.

A new website, ruralhealthycommunities.ca, contains the tool kit and other resources, including case studies and workshop videos. Caldwell hopes to make the website a one-stop online shop for rural planners and policy-makers.

Under recent funding from Public Health Ontario, his team will create educational materials and resources for University planning, engineering and public health programs, helping to ensure that they have materials focused on rural communities.

This research is funded by the Knowledge Translation and Transfer program, which receives funding from Growing Forward 2, a federal, provincial and territorial initiative, and from the OMAFRA-U of G Agreement. Additional funding is provided by Public Health Ontario.

Network helps develop effective veterinarian-farmer connections

Karen Mantel

Diverse careers in veterinary medicine hold a particular interest for Melanie Barham. She began working in equine medicine but took an alternative career path to become coordinator of the Ontario Animal Health Network (OAHN) in 2014.

As a collaboration between the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) and the University of Guelph's Animal Health Laboratory (AHL), OAHN comprises expert networks in food, companion animals and wildlife.

The focus: Coordinated early detection, preparedness and response to animal health and welfare, through sustainable cross-sector networks in public health, food safety and production.

"Farmers love to talk to students. It's a fantastic opportunity to learn to talk to clients in a more casual setting."

"We want to provide practical, timely info that veterinarians and producers can use on-farm to make better decisions for animal health and welfare," says Barham.

She says the networks have been particularly successful at translating data into useful information for veterinary practitioners.

Barham's clinical background is pivotal in her role with OAHN in different areas of the animal health industry. It also helps as the network develops its social media and communications presence, finding a voice that veterinarians and producers trust.

After graduating from U of G's Ontario Veterinary College (OVC) in 2007, Barham completed an equine internship in California before joining a practice near Ottawa for a year. She then worked at an equine practice in southern Ontario before moving to OAHN.

Barham says she gained invaluable hands-on opportunities at OVC through fourth-year rotations among areas of clinical veterinary medicine, offered through the Veterinary Capacity Program (VCP) funded by the OMAFRA-U of G Agreement. She says particularly invaluable was an eight-week externship that began the fourth year of the DVM program.

Relationship-building and communication skills stand out for her. The externship offers an opportunity to hone these skills not just with the client but also with the practitioner, she notes.

"Farmers love to talk to students. It's a fantastic opportunity to learn to talk to clients in a more casual setting. You are there to do a procedure and you are there to be efficient, but you are also there to be part of that relationship."

Building relationships is key to OAHN's success.

Many of the network co-leads worked in private practice initially and have maintained relationships with their respective groups. "I think their success has been built upon their ability to understand and interact with practitioners," says Barham.

That's echoed by Christa Arsenault, co-lead of the OAHN Swine Network with practitioners Mike DeGroot and George Charbonneau, who recently retired.

Arsenault is one of a number of OMAFRA veterinarians who co-lead an OAHN network. Along with her co-leads, she organizes the network's quarterly calls, triages information, and prepares reports for swine practitioners and producers.

Before joining OMAFRA as a lead veterinarian in animal health and welfare, Arsenault worked in mixed animal practice on swine and with the Canadian Food Inspection Agency. That experience helped her to build relationships and learn about the industry — vital to her role with OMAFRA and OAHN.

Along with clinical training through VCP, practical experience is critical, she says. "The experience in practice allowed me to develop those relationships and to understand that specific industry."

"There are more and more vets taking on roles such as I have — veterinarians are stepping into roles related to antimicrobial resistance, in government roles, with vaccine companies, with industry, in academia and in research."

Barham's interest in diverse careers and her love of writing have morphed into the DVM Project (thedvmproject.com). Under the project, she posts blogs of interviews with veterinarians who have opted for paths outside of clinical practice. The blogs have been well received by veterinarians interested in alternative careers.

"After I left practice, I saw some of the amazing ways that veterinarians are contributing to public health and to animal health and welfare, in so many ways that I never would have considered in practice or as a student."

The Veterinary Capacity Program receives funding from Growing Forward 2, a federal, provincial and territorial initiative, and from the OMAFRA-U of G Agreement.

Photo: Karen Mantel

"We want to provide practical, timely info that veterinarians and producers can use on-farm to make better decisions for animal health and welfare."
— Melanie Barham

Closing the agri-food labour gap

Training today's students for tomorrow's agri-food workforce

| Marika Li

Ontario's $36-billion agri-food industry and rural sectors are thriving and need a steady stream of highly skilled workers. The OMAFRA-U of G Agreement invests in future generations of leaders through cutting-edge research, laboratory and veterinary training.

A large gap exists between labour demand and available workers in the agricultural sector — by 2050, that gap could exceed 100,000 jobs. A report from the Ontario Agricultural College, called *Planning For Tomorrow 2.0*, says four jobs exist for every graduate.

Agriculture is also an aging profession, as the majority of Canadian farmers are at least 50 years old.

Highly qualified personnel, or HQP, are workers who have completed higher education at the bachelor's level or above and can take on highly skilled occupations. Demand for HQP generally increases with technological change and global shifts toward knowledge-based jobs. Increasingly mechanized farms, precision agriculture and sustainable practices all require higher technological and scientific knowledge.

This program is funded by Growing Forward 2, a federal, provincial and territorial initiative, and through the OMAFRA-U of G Agreement.

Since 2010, the agreement has fostered new agri-food leaders through several programs:

Undergraduate student experiential learning (USEL)

35 graduates

Ontario Agricultural College students in the third year of their bachelor's degree who hope to work in the agri-food or rural sector

Hands-on experience through a research project under the mentorship of OMAFRA staff and U of G professors

Research projects complement U of G's curriculum and relate directly to current issues in Ontario agriculture. USEL allows students to explore their interests and prepare for future employment in the agri-food sector.

Highly qualified personnel (HQP) graduate scholarships

125 graduates

U of G doctoral and master's thesis students

Annual scholarships worth $17,300 to $21,000, a course on integrating business and agri-food science, and a work semester with a government, agri-food industry or community partner

These scholarships support future generations of researchers, innovators and policy-makers in the industry. HQP students learn how research knowledge translates into cost-effective innovations or evidence-based public policy.

In 2011, only 9.9 per cent of farms in Canada were operated by farmers younger than 40 years old.
– Statistics Canada

"I received constant support and learned things far more tangible than from lectures or papers."
—Evan Bleakney, animal biosciences, USEL

"I really benefited from this program by forming connections to industry professionals."
—Paighton Smyth, animal biosciences, USEL

"I learned the value of building trust and long-term working relationships with clients."
—Patrick Hendricks, plant agriculture, HQP

"The HQP program will dramatically improve my future employment prospects."
—Jared Stoochnoff, plant agriculture, HQP

Graduate students in research projects funded by the OMAFRA-U of G Agreement

Every year, several hundred master's and doctoral students gain experience working with faculty supervisors on research projects in provincial agri-food and rural priorities. These projects include innovations in animal health, food quality, rural economics and precision cropping.

This experience teaches students technical skills and knowledge for successful careers and helps develop the province's agri-food and rural sectors.

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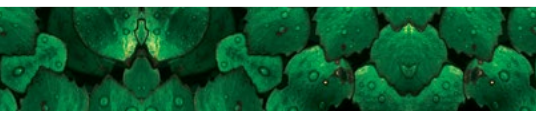

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