OMAFRA – University of Guelph Partnership

research

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Number 2 | Agri-Food
Summer 2015 | Yearbook

MEETING THE CHALLENGE

These homegrown plants are hardier than imports. **SEE PAGE 10**

Plant agriculture graduate student Emily Moeller is working to develop new Ontario-bred varieties for the province's $4-billion horticulture industry.

INSIDE

Growing Ontario's agri-food industry for jobs and prosperity

Ontario

University of Guelph

Changing Lives Improving Life

PHOTO: SHUTTERSTOCK

Research that yields valuable results

Welcome to the pages of *Research* magazine's Agri-Food Yearbook. I am delighted to see some of the great work being done as part of the Ontario Ministry of Agriculture, Food and Rural Affairs – University of Guelph partnership highlighted and shared in this issue.

This work is yielding valuable results that have a real impact on the agri-food sector in Ontario. Supporting farm businesses and the agri-food industry, whether through the development of animal health security or through social media connections, is good for Ontario's economic growth and for creating jobs.

The important work portrayed on the cover is an example of research contributing to current industry and government goals. Specifically, this research responds to industry's need for adaptation to climate change. These developments support the replacement of imports with homegrown products, which is part of the focus of the Premier's Agri-Food Challenge to the industry to double its annual growth rate by 2020.

Jeff Leal
Minister of Agriculture, Food and Rural Affairs

Ontario farmers highly value research. They know crop and livestock production depends greatly on evidence-based approaches to the challenges and opportunities before them. Consumers, too, value research for the products it yields, many of which appear on their dinner tables and elsewhere in their homes.

Through the Ontario Ministry of Agriculture, Food and Rural Affairs – University of Guelph partnership, the ministry supplies about half of the University's annual research funding. This outstanding partnership helps create a foundation for research that goes far beyond traditional boundaries and adds extra value to researchers' innovative solutions.

The ministry's support has helped U of G become known as "Canada's food university." We take this role very seriously, and accept it with great pride. From basic production to product development, our researchers help Ontario farmers produce safe, affordable food for consumers. The pages of this Agri-Food Yearbook outline highlights of that game-changing research.

Franco J. Vaccarino
PhD, FCAHS
President and Vice-Chancellor

research

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Highlighting the partnership for research, laboratory and veterinary programs between the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) and the University of Guelph

Ontario

University of Guelph
Changing Lives Improving Life

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contributors

Mallory Kohn

Mallory Kohn is a psychology major from Port Perry, Ont. Mallory used her zest for reading and her keen interviewing skills to learn how researchers are using coffee grounds to create plastic-like biodegradable packaging. Look for her article on page 6.

Alaina Osborne

Originally from Guelph, Alaina Osborne is a second-year studio arts major with a passion for writing and visual arts. In this issue, Alaina writes about Ontario apples and the importance of healthy roots. Read her article on page 18.

Alexandra Sawatzky

Alexandra Sawatzky, originally from Kitchener, Ont., is a fourth-year bachelor of arts and science student. Read her story about a disease prevention program for Ontario's commercial rabbits on page 33.

Maritza Vatta

Third-year biochemistry student Maritza Vatta from Toronto wrote this issue's cover story about Canadian wildflowers and how they have adapted to climate change. Read about the future impact of this research on page 10.

Anna Wassermann

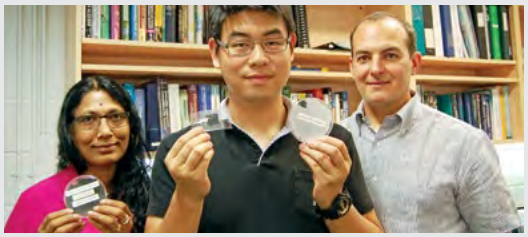
Anna Wassermann is a third-year bachelor of arts and science student from Toronto. Anna wrote about research aiming to remove organic residues and nutrients from vegetable processing water. See how this technology is improving the treatment of water on page 15.

PHOTO: SPARK

PHOTO: MARTIN SCHWALBE

India Annamanthadoo

India Annamanthadoo is a second-year biomedical sciences student from Toronto. For this magazine, India was able to learn about the future of eco-friendly cell technology. Read her article about up-and-coming biodegradable phone options on page 26.



CODY G. THOMPSON

Functional flora

Patentable technologies are being developed for green roofs

The increasing demand for green roof installations throughout North America means more quality green roof plants, growing substrates and production systems are needed. University of Guelph researchers are responding with new patentable technologies to help expand the industry while continuing to improve operations for existing green roof companies.

Led by Prof. Youbin Zheng, School of Environmental Sciences, Guelph's green roof research program is working to commercialize its innovations and increase green roof accessibility. A new company, Smart Green Technologies Inc. (SGT), was recently launched by Greg Yuristy, one of Zheng's former graduate students.

"SGT is implementing our technologies to make installing high-quality green roofs easier and more cost-effective," says Zheng. "These research results are helping growers to meet increasing demand for green roof plants, among many other horticultural applications."

Green roofs are supported by engineered soil (called growing substrate), topped with a layer of vegetation on their outermost surface.

Uptake has been hampered by a limited selection of substrate and plant varieties to suit the needs of various kinds of rooftops, particularly in colder climates.

But this is changing. Zheng's lab has developed and patented soilless, pre-vegetated mats, which are much more resilient to harsh North American climates. Further, they are enabling companies such as SGT to install green roofs more efficiently. Plantings can now be established within four to six weeks, as opposed to one year.

The other technology in the process of being patented at U of G's Catalyst Centre—prefabricated substrate blocks—enables green roofs to be installed on sloped roof surfaces. Previously, this was very challenging. Zheng says these developments are helping to expand the reach of green roofs to even more commercial and residential settings.

Green roofs also require particular fertilization, weeding and irrigation practices. To that end, Zheng's team provides specific guidelines for optimum growing conditions and plant maintenance following installation. This allows existing companies and farmers to address challenges and improve their practices.

Billions of square feet of potential green roof space exist in North America, and with Zheng's knowledge about green roof-specific plant production, post-installation management and green roof plant varieties, companies are already tapping into this market.

"Many green roof systems manufacturers have been using our technologies with great success," says Zheng. "We're demonstrating how university-led research can change and improve an industry's practice."

— India Annamanthadoo and Alexandra Sawatzky

Collaborators on this project include Prof. Mike Dixon, Greg Yuristy, Mary Jane Clark and Katherine Vinson as well as various graduate and undergraduate students. Additional support is provided by Mike Tulloch of Tulloch Engineering.

This research is funded by the OMAFRA – U of G partnership. Additional funding is provided by OMAFRA Proof-of-Principle Fund, Natural Sciences and Engineering Research Council, SAP, LifeRoof® Ontario, Sedum Master, Carrot Common, Xeroflor Canada, Landscape Ontario and Ontario Centres of Excellence.

Brown is the new green for coffee grounds

Reduced waste stream and new revenue stream are a willing double-double

Nearly nine out of 10 Canadians drink at least one cup of coffee every day—and with every cup comes a pile of coffee grounds. In fact, 800,000 tonnes of grounds are dumped in landfills every year.

To reduce waste, food science professor Loong-Tak Lim is using spent coffee grounds to develop biodegradable composite packaging. His team has developed a method to incorporate processed spent coffee grounds into poly(lactic acid) (PLA)—a biodegradable polymer derived from renewable resources, such as corn. When extruded, the PLA and spent coffee grounds form a relatively flexible plastic composite sheet that can be used for packaging. The resulting material is also compostable, carbon neutral and eco-friendly.

"From an industrial standpoint, the amount of spent coffee is tremendous," says Lim. "Industries need to find a way to manage coffee waste. One answer is to compost it into biodegradable packaging."

Currently, PLA has some application as a compostable packaging material, but it lacks versatility because it's brittle and stiff. But when combined with coffee grounds, the PLA products become 200 to 300 per cent more flexible. Lim is now trying to determine which spent coffee components confer this desirable material property in PLA.

The process to combine the two ingredients is fairly simple. First, the coffee grounds are treated and pulverized into powder. Then they're heat-extruded with PLA into a sheet. The resulting biodegradable sheet has a semi-opaque appearance and can potentially be used to make holding trays, containers, sleeves for cups and biodegradable garbage bags.

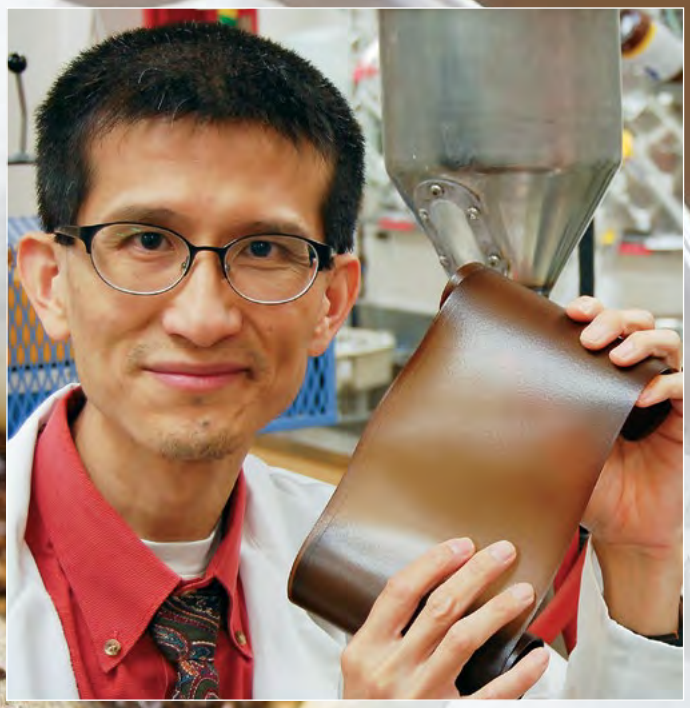
Lim says this process could add value to the coffee beans, benefiting coffee processors by adding a new revenue stream and diverting a waste disposal stream.

From an environmental viewpoint, a biodegradable composite with the potential to replace petroleum-based food and consumer packaging is a step in the right direction.

Next, Lim will look at the compostability of the coffee ground-PLA compound and how quickly it will degrade in compost. Ultimately, he hopes to take the biodegradable coffee waste composite to packaging industries to determine whether the product can be scaled up.

—Mallory Kohn

This research is funded by the OMAFRA – U of G partnership. Additional funding is provided by CGS Foods Inc. and Bi-Ax International Inc.Tim Hortons Inc. provided in-kind support.



Prof. Loong-Tak Lim and biodegradable packaging material

PHOTOS: SPARK · SHUTTERSTOCK

Millet: It's not just for the birds

Food scientist searches for the best varieties of this supergrain

Millets—a diverse group of small-seeded grains that are important dietary staples in many regions of the world—contain high levels of protein and fibre. They're nutritionally superior to many popular cereal crops, such as rice. In fact, some people call them supergrains.

Prof. Massimo Marcone

PHOTO: SPARK

In North America, millet is predominantly grown for birdseed, mainly because farmers here don't have access to an array of "super" varieties.

Food science professor Massimo Marcone wants to change that. He says several species of millet exist and some may be better than others for their potential to enhance human health. He's identifying which ones would be best to develop from a nutritional perspective.

"We're trying to help Ontario farmers expand production to higher-quality millets that may be more appealing to consumers," says Marcone. "These can be segregated and sold as identity-preserved varieties, distinct from birdseed."

Marcone says consumers are typically willing to pay more for products that offer direct health benefits. Generating awareness about the functionality of millet in food and diversifying production to value-added varieties would in turn increase the agricultural value of this grain, he adds.

For this study, Marcone incorporated millet flour into familiar products such as breads and cookies. He identified the most nutritious varieties by comparing the digestibility of their distinct starch structures.

Millet contains high levels of resistant starch. In the bloodstream, resistant starches break down more gradually, preventing large changes in blood sugar.

"Millets abundant in resistant starch can improve the body's insulin response," says Marcone. "They can be part of the development of more effective treatment and mitigation strategy for Type 2 diabetes." As well, because resistant starches take longer to digest, they may also help individuals feel fuller longer and sustain energy levels. That's beneficial for weight management.

Marcone also found that the amount and type of fatty acids present in millet flour contributed to its beneficial properties, demonstrating the additional positive aspects of the interactions between resistant starch and other food components.

"These results are providing us with the means to evaluate the suitability of various millets for human consumption," says Marcone. "Future studies should draw comparisons between a broader number of varieties to optimize both the nutritional and agronomic potential of this supergrain."

—Alexandra Sawatzky

Others involved in this research were food science PhD graduate George Annor and the late Prof. Koushik Seetharaman.

This research is funded by the OMAFRA – U of G partnership.

Sticking to their mission: more effective probiotics

Probiotic food products such as yogurt line health and grocery store shelves. Now, livestock may be able to benefit, too, thanks to the efforts of Prof. Cezar Khursigara, Department of Molecular and Cellular Biology.

Prof. Cezar Khursigara

PHOTO: MARTIN SCHWALBE (ABOVE) · ISTOCKPHOTO

Probiotics are live bacteria found in some food products or dietary supplements. They can provide important health benefits such as aiding in the digestion of fibre and carbohydrates, protecting against harmful bacteria, and helping to maintain healthy interactions between the non-pathogenic commensal bacteria that normally inhabit our bodies.

Many health professionals believe that probiotics may be the solution to antibiotic resistance, which has had a large impact on both human and animal health.

However, the shortcoming of probiotics is that they are transient, meaning they pass through the digestive system without being incorporated into the resident microbial communities—and without providing as many health benefits as they could.

Khursigara says probiotic biofilms would address the transience issue, and could have far-reaching applications. In the livestock industry, probiotics in feed could serve as an alternative to supplementation with antibiotics, which have become increasingly less effective with the rise of antibiotic resistance. In the competitive food and feed market, an effective, antibiotic-free alternative feed could give Ontario's food and livestock industries a competitive edge.

To address this challenge, Khursigara's team has looked at biofilms, tightly knit bacterial communities that can form on nearly any surface. Bacteria have a strong propensity to form biofilms; they can consist of either beneficial bacteria such as probiotics or harmful pathogenic bacteria.

"The mechanism of biofilm formation is similar in both models," says Khursigara. "But pathogenic biofilms are more commonly studied and understood because they are linked to many recurrent chronic infections, such as cystic fibrosis."

According to Khursigara, the hallmark trait of pathogenic biofilms is that they are able to persist in their environment for a long period of time; conversely, probiotic biofilms are almost non-existent in practice. His goal is to understand and apply the mechanisms of pathogenic biofilm formation to probiotic bacteria, in an effort to create probiotic biofilms that "stick" to the gut, rather than just pass through it.

"Trying to understand the fundamental mechanism that drives biofilm formation is going to help us in a lot of ways," says Khursigara. "The peripheral uses of our research could spawn innovation for years to come."

The team is now publishing its first research paper on the material, in which the members evaluated and characterized various probiotics as a necessary first step in their work.

—India Annamanthadoo

This research is funded by the OMAFRA – U of G partnership. Additional funding is provided by Lallemand.

cover story

Meeting the challenge

These plants are adapting to climate change, naturally

When it comes to climate change, Canadian wildflowers have seen it all – cold, heat, drought and floods—with basically no intervention from humans. As a result, they've had to continuously adapt, and Prof. Alan Sullivan, Department of Plant Agriculture, thinks they'll keep on doing it.

"Most ornamental plants you see today started as a native species somewhere," he says. "They've just been bred to a point where their current form is now what we grow."

Sullivan is studying native plants' adaptation to help the Canadian horticulture industry deal with climate change. He hopes the knowledge he's acquiring will lead to short- and long-term production approaches for Canadian nursery plant producers and gardeners.

His focus is on developing ornamental native varieties (those that could be used primarily for landscaping) that can adapt to what he calls low-input environments. In these settings, plants may have little access to water or nutrients, but still flourish and maintain their visual appeal.

"Having plants that can grow with little or no maintenance creates a new market for consumers and exporters, both nationally and internationally," says Sullivan. "These plants will be adapted to the low-input environments we're increasingly seeing."

Sullivan and graduate student Emily Moeller are choosing plants with characteristics such as drought resistance, wide adaptation, ease of growing, attractiveness and long bloom time. Key to this work is Moeller's research to develop a new tissue culture system. It's expected to be able to propagate the low-maintenance plants up to 20 times faster than conventional processes.

Sullivan says this will provide Ontario growers with an ample supply of the domestically grown plants. Furthermore, it will help them avoid the royalty charges currently charged for imported plants. In fact, the varieties Sullivan is looking at are entirely Canadian. "This allows our growers to become the dominant suppliers, with the added advantage of being able to sub-license to everyone else in the world," he says.

Right now, Sullivan and Moeller are focusing on the native ornamentals *Monarda fistulosa* (popularly known as bergamot) and *Monarda punctata* (spotted bee balm). Interestingly, both of these ornamentals produce beneficial essential oils. If all goes well, the researchers will broaden their scope to many other native plants.

— Maritza Vatta

This research is funded by the OMAFRA – U of G partnership. Additional funding is provided by the Gosling Research Institute for Plant Preservation.

PHOTO: MARTIN SCHWALBE - SHUTTERSTOCK

Plant agriculture graduate student Emily Moeller (left) and Prof. Alan Sullivan

***Monarda fistulosa*, popularly known as bergamot**

Progress toward effective pest management

Effective pest management strategies are an ongoing challenge for Ontario field vegetable producers. Vegetable diseases and pests are constantly evolving and becoming resistant to pesticides, including fungicides and insecticides.

To try to get ahead of the evolutionary curve, Ridgetown Campus researcher Cheryl Trueman has spent the last three years conducting field trials to evaluate novel products for disease and pest control on vegetables in Ontario.

"There is a need among vegetable growers to identify the best management processes, to delay the evolution of pest resistance to fungicides and insecticides," says Trueman.

In addition to looking at the efficacy of pest control products, she also studied alternative pesticide application methods and cultural control methods. Among the many findings, Trueman says, two in particular will be helpful to industry.

Ridgetown Campus researcher Cheryl Trueman

PHOTO: LIZ MEIDLINGER

Cyazypyr decreases damage from pests on cole crops

Cole crops are plagued by pests such as cabbage looper, diamondback moth and imported cabbageworm that feed on foliage and cause defoliation. In her trials at Ridgetown, she found that applying the novel in-furrow insecticide Cyazypyr kept damage in check as effectively as a foliar insecticide spray program in the first few weeks after transplanting.

When used in combination with foliar insecticides, in-furrow applications of Cyazypyr reduced the total number of insecticide applications needed, compared to foliar applications alone. (In-furrow insecticides are applied into the furrow at transplanting and are taken up by plants as they grow, while foliar insecticides are sprayed onto plant foliage when grown.)

In similar trials at Elora, in-furrow applications were less effective because of the presence of swede midge, which Cyazypyr does not control.

Presidio reduces severity of downy mildew on cucumbers

Downy mildew is an aggressive disease that is characterized by dead areas within leaf veins, angular leaf spots, grayish-purple growth on the undersides of leaves and severe defoliation. Failure to prevent this disease can result in a total yield loss. Researchers evaluated the novel fungicide Presidio and found it provided good control of downy mildew, alone and in rotation with other downy mildew-targeted fungicides. Thanks in part to Trueman's research, Presidio is now registered for use as a new resistance-management product for downy mildew management on cucumbers.

These results and others have been shared with growers and the public through presentations and workshops. In addition, detailed results have been supplied to chemical companies for inclusion and consideration in company and government submissions for pesticide registration.

— Mallory Kohn

Trueman worked with Prof. Rebecca Hallett, School of Environmental Sciences, and OMAFRA vegetable crops specialists Janice LeBoeuf, Elaine Roddy and Marion Paibomesai.

This research was funded by the OMAFRA – U of G partnership. Additional funding was provided by Ontario Processing Vegetable Growers, Ontario Cucumber Research Committee, Ontario Tomato Research Institute, Valent Canada, BASF Canada, Dow AgroSciences, Bayer CropScience, USDA Pest Management Alternatives Grant and Syngenta Crop Protection.

Enhancing immunity in poultry

Vaccines and immune strategies to help control viral diseases

More people are eating chicken—in fact, there has been a steady increase in consumption from a little more than 22 kg/person in 1992 to more than 30 kg/person in 2014. That increasing market demand is driving new poultry research efforts in many fields, including infectious disease control.

Pathobiology professors Shayan Sharif and Éva Nagy are studying chickens' immune response to viral infections to develop more effective vaccines and disease control strategies.

"Our goal is to reduce clinical disease and virus shedding from vaccinated and infected birds," says Sharif. "By researching chicken immune systems, we can work towards improved disease resistance in poultry flocks."

Specifically, Sharif and Nagy are looking at avian influenza virus, Marek's disease and fowl adenovirus.

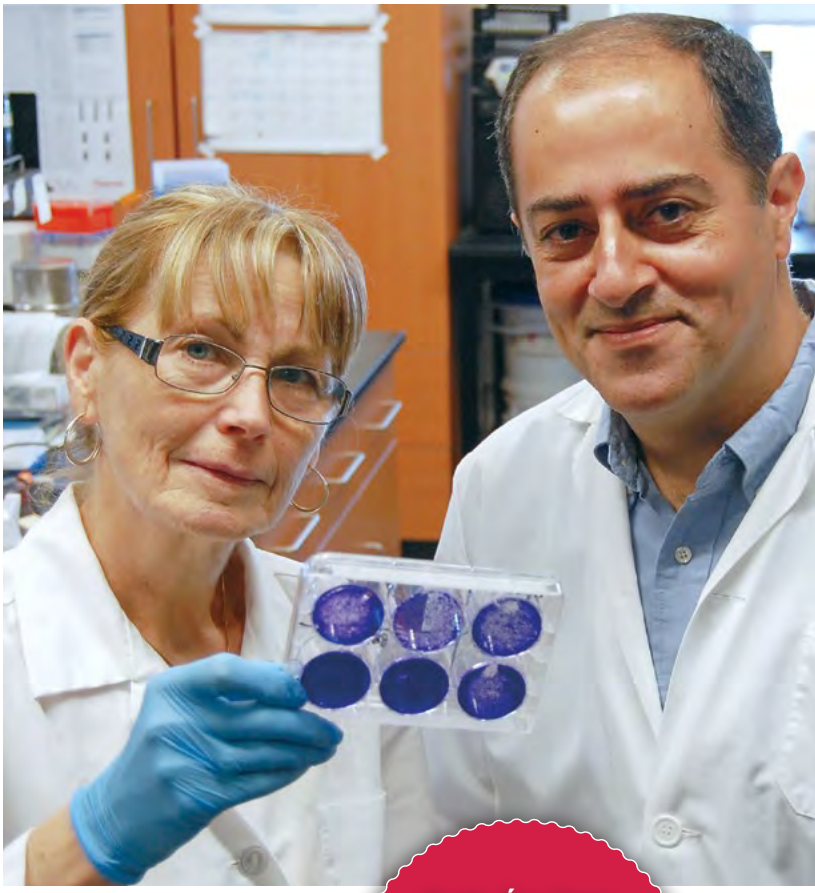
Avian influenza, commonly known as bird flu, has only a few vaccines available for particular strains of the virus. So Sharif and Nagy are developing new killed or inactivated vaccines to provide a more comprehensive arsenal against the disease.

Marek's disease virus is another pathogen on their hit list. The existing vaccine doesn't prevent this highly contagious virus from being shed to the environment or transmitted to other chickens, so those are priorities for Sharif's vaccine work.

For her part, Nagy is looking at ways of using fowl adenovirus as a vaccine vector. The adenovirus is harmless and, when used as a vector, can transport and express genetic codes of other viruses. Once in the vaccinated bird, it stimulates an immune response against those viruses.

Nagy has worked with fowl adenovirus FAdV-9, a strain that does not cause disease in poultry. She hopes to use this virus as a vector to enhance immunity against diseases such as avian influenza and infectious bronchitis virus.

The researchers are also screening adjuvants, substances that help a vaccine to stimulate a stronger and long-term immune response. Sharif and Nagy have investigated an adjuvant called CpG-ODN, a synthetic DNA molecule that showed significant effectiveness in stimulating chickens' immune systems.



Profs. Éva Nagy (left) and Shayan Sharif are developing new approaches to infectious disease control in poultry.

PHOTO: SPARK

The researchers are incorporating adjuvants into vaccines to be delivered to chickens' mucosal tissues, such as the respiratory system, and oral and nasal cavities. These tissues are exposed to the environment, and many of the microbes that cause disease in chickens or humans are acquired through this route. Sharif and Nagy say this underscores the importance of developing a strong line of defence in these tissues to protect animals against disease-causing microbes.

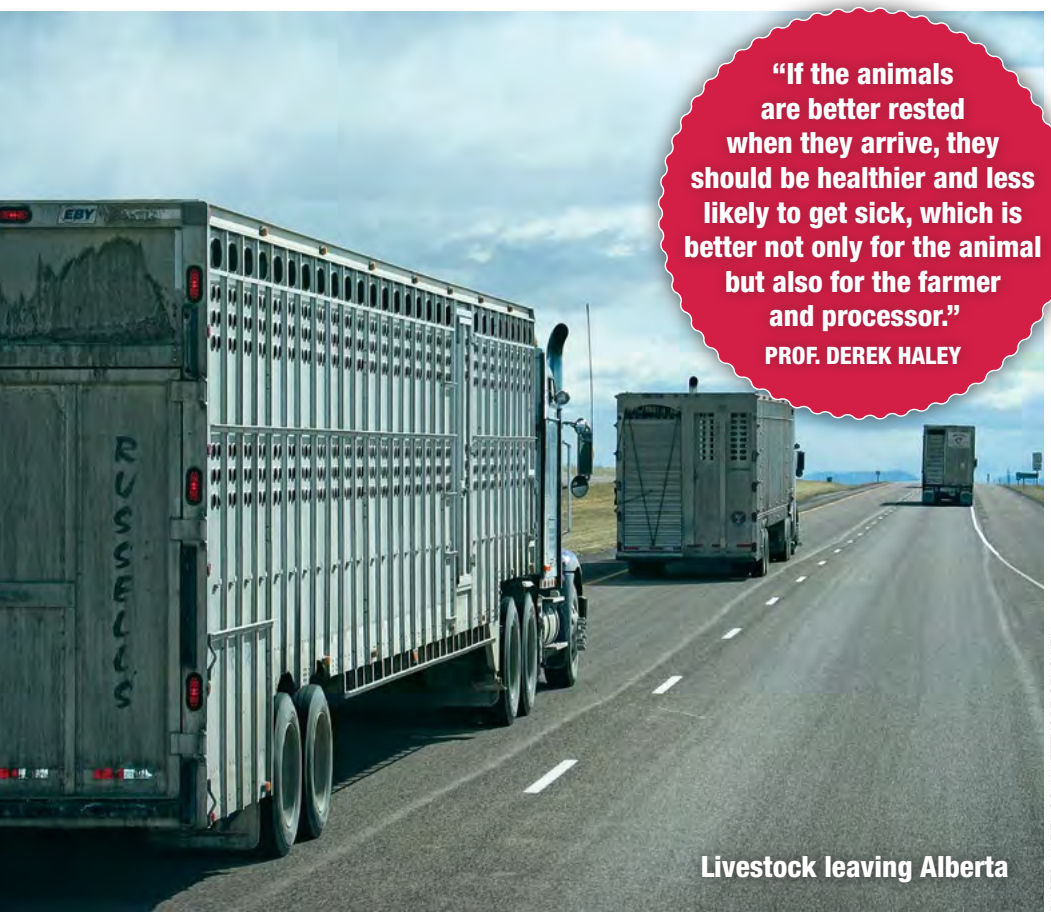
—Mallory Kohn

This research is funded by the OMAFRA – U of G partnership. Additional funding is provided by the Ontario Ministry of Agriculture, Food and Rural Affairs, Canadian Poultry Research Council, Agriculture and Agri-Food Canada, Poultry Industry Council, and Natural Sciences and Engineering Research Council.

Driving toward healthier livestock transport

Researchers look at cattle movement from Western Canada

About 250,000 cattle are transported by truck from Western Canada to Ontario and Quebec annually; most are brought here to be finished in feedlots before being processed for consumption. The trip can take more than 50 hours, and regulations are currently in place to ensure the well-being of the animals. Prof. Derek Haley, Department of Population Medicine, is conducting research to better understand how the animals are coping, or whether their experience can be improved.



"If the animals are better rested when they arrive, they should be healthier and less likely to get sick, which is better not only for the animal but also for the farmer and processor."
PROF. DEREK HALEY

Livestock leaving Alberta

PHOTO: KAREN SCHWARTZKOPF-GENSWEIN

"We have plenty of research on best management practices for beef cattle while they're on farms and ranches," Haley says, "so why not also fine-tune practices related to the transportation process, including those dealing with feed, water and rest?"

Current legislation states that if a transport truck cannot get to its destination within 52 hours, the cattle must be unloaded and fed, watered and rested along the way for a minimum of five hours. There are two commercial rest stations, both located near the halfway point, Thunder Bay, Ont. Cattle are unloaded from the transport trucks and given feed, water and space to rest.

One of the rest stops allowed Haley access to its facilities to collect data such as the number of trucks stopping and weight class of cattle. Haley found that the loads were mostly feeder calves, and that the trucks on average rested for more than double the required hours.

"This is a good-news story for the industry," says Haley. "They are exceeding the legislated requirements."

Haley is studying the animals' behaviour and the management practices at the rest stations. He is interested to learn whether animals in transit need more feeding space or bedding so they are better able to safely cope with the journey.

Haley hopes that better management during all aspects of transportation will result in healthier animals upon arrival.

"I want to find ways within the system already in place to maximize the benefits for the animals," says Haley. "If the animals are better rested when they arrive, they should be healthier and less likely to get sick, which is better not only for the animal but also for the farmer and processor."

—Maritza Vatta

Project collaborators are Karen Schwartzkopf-Genswein, a beef cattle welfare scientist at Agriculture and Agri-Food Canada (Lethbridge), and recently retired University of Guelph professor Ken Bateman. Students involved in these projects are Hannah Flint, Ray Stortz and Misha Buob.

This research is funded by the OMAFRA – U of G partnership. Additional support was provided by the Canadian Food Inspection Agency and Thunder Bay livestock rest station owner Walter Drazeky.

Cleaner water, lower costs

Graduate student Adam Moore (foreground) and Prof. Richard Zytner

PHOTO: MARTIN SCHWALBE

Preventing processors' profits from going down the drain

In the food processing business, waste-water treatment can be costly. It's a significant challenge for a sector trying to keep costs low in order to remain competitive in the market.

Prof. Richard Zytner of the School of Engineering at the University of Guelph is leading a team of researchers and graduate students investigating the effectiveness of two technologies for removing organic residues and nutrients from vegetable processing waste water.

Specifically, Zytner is interested in how effective the technologies are at reducing biochemical oxygen demand, suspended solids and nutrients such as nitrogen and phosphorus to comply with municipal sewer discharge limits.

"Most processors know how to handle food safely, but they don't necessarily have the in-house expertise to treat their waste water," says Zytner. "We're trying to find a treatment system that's effective and can also be operated easily by the companies themselves."

Zytner and his team are adapting two existing technologies to work in various food processing settings. Both technologies separate water from solids to provide municipal water management systems with cleaner effluent for cheaper disposal into sewers.

The first technology is called a sequencing batch reactor. Despite its elaborate name, Zytner says it's a relatively simple technology in which waste water undergoes all the stages of treatments—mixing, aeration and settling—in the same reacting chamber.

The second technology is an aerobic membrane bioreactor, a newer system that uses suction to filter waste water through a membrane tube with many tiny pores. The membrane bioreactor carries out the same biological processes as the sequencing batch reactor, but the treatment time is a bit longer. The benefit of this system is that more solids are filtered out, providing a better quality of effluent. There is also potential for recycling of the waste water.

The research is still under way, but Zytner is optimistic about its potential.

"If we're successful, we can reduce the organic load discharged to the municipal sewer system, saving the company money and allowing the municipal waste-water treatment system to operate more efficiently. This will save the taxpayers money," says Zytner. "There's a cascading effect here. If we help the companies, we help the municipalities, and everyone benefits, including the environment."

Zytner hopes to take the research one step further to determine whether waste water can be recycled. Additionally, he hopes to determine whether the treatment technologies he's studying can be applied to other agri-food sectors, including dairy and meat production.

—Anna Wassermann

Collaborating on this research are Profs. Sheng Chang, School of Engineering, and Keith Warriner, Food Science, as well as master's student Adam Moore and master's graduate Ka (Shirley) Lam.

This research is funded by the OMAFRA – U of G partnership. Additional funding is provided by OMAFRA and the Canadian Water Network.

The mystery behind red clover non-uniformity

It turns out drought-related factors may be at play

Researchers Amélie Gaudin (left) and Cora Loucks

PHOTO: AMÉLIE GAUDIN

Underseeding red clover to winter wheat as a cover crop provides long-term soil fertility, environmental sustainability and resilience in wheat-corn-soybean crop rotations. But farmers are reluctant to use red clover because of non-uniformity of the stand. The crop tends to grow in variably sized patches in the field.

Plant agriculture professors Ralph Martin and Bill Deen, along with post-doctoral researcher Amélie Gaudin and graduate student Cora Loucks, wanted to know why. Previous research suggests that non-uniformity occurs after establishment and is related to the lack of water availability during the relay cropping period. (Relay cropping is a version of double cropping, where the second crop is planted into the first crop before harvest.)

"Early indications appear to support the hypothesis that clover stand variation is due to drought-related factors," says Gaudin.

The researchers conducted experiments at Arkell Research Station to monitor the effects of water regimens on red clover stands under the wheat canopy at different stages of clover growth. They discovered that low soil moisture under the wheat canopy decreases red clover survival.

Nonetheless, they support red clover as part of a cropping system. "Red clover lowers the risk of corn and soybean failure during drought because underseeded red clover improves crop yield resilience to low soil moisture," says Gaudin. As part of their research, Martin, Deen and Gaudin analyzed 30 years' worth of data and learned red clover helps to produce more resilient and sustainable cropping systems. They found during drought, underseeded red clover increased corn yield resilience by seven per cent and soybean yield 22 per cent.

Now, the researchers are interested in understanding the mechanisms involved in decreasing cropping system vulnerability to low soil moisture. They are investigating how rotations and tillage alter the amount of plant-available soil water, plant ability to use water resources and the effect on crop yields under drought stress.

— Mallory Kohn

OMAFRA collaborators are Peter Johnson, provincial wheat specialist, and Greg Stewart, provincial corn specialist.

This research is funded by the OMAFRA – U of G partnership. Additional funding is provided by Grain Farmers of Ontario.

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Official opening launches Livestock Research and Innovation Centre

The construction of the new Livestock Research and Innovation Centre at Elora is complete. The dairy herd will be transitioning to the new facility shortly, following an official opening that took place in May. Research projects will officially begin in September.

The centre will house 240 free stall cows in eight groups for replication of research trials, and 24 cows in tie stalls for projects where more research instrumentation and cow monitoring is required.

Special needs housing such as maternity and calf nurseries is also available.

Traditional ventilation systems have been enhanced with environmental controls to help ensure the accuracy of research results. A rotary parlour complete with a voluntary milking robot provides a variety of data collection methods for research trials and simulates the differing requirements of the dairy industry. There are facilities for preparation of laboratory samples and space for future fractionation equipment for further processing of milk on-site.

Through all the construction and planning, careful consideration has been given to complying with the housing guidelines of the Canadian Council for Animal Care and Animals for Research Act regulations.

The centre, owned by the Agricultural Research Institute of Ontario (ARIO), was built in co-operation with the Livestock Research and Innovation Corp., a not-for-profit research consortium of livestock commodity organizations.

—Robyn Meerveld and Remo Pallottini

Construction of the $25-million dairy research centre was funded by the province ($20 million) and Dairy Farmers of Ontario/industry partners ($5 million, including $3 million from Agriculture and Agri-Food Canada). Ongoing operational costs will be supported by the OMAFRA – U of G partnership and ARIO.

PHOTO: DAVID BARR / PHOTOBAR

Homegrown apples start with the root

For Ontario apple growers, a great orchard starts with the root. In fact, the majority of apple trees seen today are not actually growing on their own roots. Instead, shoots or twigs (scions) containing buds from a woody plant are grafted or joined together with specially selected rootstocks.

Usually, a plant or stump is used that already has an established healthy root system. The benefit of the process is that rootstocks can be selected for particular traits and growing conditions, such as soil type and size of tree at maturity. This tailor-made approach can save an apple grower time and labour.

The Ontario apple industry currently imports the bulk of its rootstock from the United States and Europe. However, these rootstocks don't always meet the needs of Ontario's growers. Prof. Praveen Saxena from the Department of Plant Agriculture and research associate Mukund Shukla are refining current micro-propagation (growing) technology for apple growers so that Ontario can create the best rootstock for its own growing conditions.

Other micro-propagation techniques exist, but they have limitations. They may be too time-consuming, limited to certain plant types, or not able to meet the demands of commercial scale

production. Saxena is working to meet these requirements by using a liquid-based bioreactor system, growing cells or tissues in a special culture that results in genetically identical and disease-free rootstock.

Developing a domestic source of rootstock achieves several important objectives. It replaces imported supplies and supports Ontario jobs. It also reduces the risk of insect and pest introduction from foreign markets, and establishes Ontario as an exporter of disease-free rootstock.

—Alaina Osborne

This research is funded by the OMAFRA – U of G partnership through Gryphon's LAAIR. Additional funding is provided by the Natural Sciences and Engineering Research Council and the Ontario Centres of Excellence.

ILLUSTRATION: DREAMSTIME

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Developing new agri-food industry leaders

Since its inception in 2009, the Highly Qualified Personnel (HQP) program has helped nearly 100 graduate students develop into future leaders of Ontario's agri-food industry.


Prof. Erna van Duren

PHOTO: SPARK

To date, the program has allocated $3.5 million to support master's and doctoral students gain unique insight into the potential commercial applications of science and technology, says co-ordinator Prof. Steven Leeson, Department of Animal and Poultry Science.

Students take part in a hands-on, specially designed business course taught by Prof. Erna van Duren, School of Hospitality, Food and Tourism Management. The course focuses on the economic, social and policy factors that shape the business environment for companies and organizations in the agriculture and food sectors.

Students also undertake a work placement for at least one semester at an industry organization, commercial business or government department related to agriculture and food in Ontario.

"The program teaches students the business side of the agri-food industry and has become an important networking platform for the University, students and industry representatives," says van Duren.

— India Annamanthadoo

The HQP Scholarship Program is funded through the OMAFRA – U of G partnership.

A bottom-up approach to dealing with drought

The Sand Plains region in southwestern Ontario could potentially be one of the most productive areas in the province for crops. But because of the nature of the sandy soil (water drains through it quickly), it is also one of the province's most drought-prone regions. This kind of water stress stunts plant growth, development and yield.

Profs. Rene Van Acker and John O'Sullivan, Department of Plant Agriculture, and technicians Robert Grohs and Peter White are trying to determine whether subsurface drip irrigation (SDI) can significantly help crop production in this region. SDI technology is new to Ontario. Water is applied directly to the roots of crops below the soil surface through drip-irrigation lines. It's a low-pressure system, with a life expectancy of 15 to 20 years.

SDI can deliver water with an efficiency rate of 95 per cent or higher, and requires less energy than conventional irrigation systems, resulting in cost savings. It also improves crop yield and quality, through more efficient use of water and nutrients. That means better environmental sustainability for these two important crop inputs.

PHOTO: PETER WHITE, UNIVERSITY OF GUELPH

The research team is currently commercializing and expanding the market for subsurface drip irrigation in Ontario.

— Mallory Kohn

Collaborators include Judge Farms and Vanden Bussche Irrigation.

This research is funded by the OMAFRA – U of G partnership through Gryphon's LAAIR. Additional funding is provided by Farm and Food Care Ontario.

Helping kids eat healthy

Nutrition education is more attractive with interactive programs

Nutrition education is important for kids making food choices. Those choices could become lifelong eating patterns.

Megan Racey, a PhD candidate who holds a Highly Qualified Personnel (HQP) Scholarship from the OMAFRA – U of G partnership, is developing programs for Grade 7 classrooms to help students make healthy choices.

She's focusing on dairy.

"Children ages nine to 13 are among the lowest consumers of dairy and dairy alternatives, which often leads to future challenges maintaining healthy bones and a healthy weight," says Racey.

Throughout her project, students will have opportunities to extend their learning beyond the classroom. Interactive games, discussions and use of technologies such as iPads will encourage constant engagement with the material and allow students to have a hand in their own learning.

Racey is now planning the methods of instruction, which she says may vary depending on classroom environments and technology accessibility. But her overall goal is to move away from lecture-style approaches to more comprehensive, discussion-based activities.

She knows that students will be more likely to use the nutritional information if they can apply it to their own lives. They will be encouraged to reflect on their personal food choices and collectively brainstorm ways to incorporate more dairy products into a balanced diet.

Discussions and games will be challenging yet fun, encouraging students to return to the program material again and again. Over time, information can be more effectively absorbed and integrated into daily practices.

PhD candidate Megan Racey talks food and nutrition with Emmitt Leacock

PHOTO: SPARK

While completing her M.Sc. in the Department of Human Health and Nutritional Sciences (HHNS) at Guelph, Racey found the project-based learning style of her coursework could be applied beyond the classroom. Now pursuing a PhD in the same area, she is using this comprehensive approach to develop her programs.

The HQP Scholarship program in which she's participating was designed to support future researchers, policy-makers and innovators in connecting society and the agri-food system. Collaboration with a wide range of stakeholders helped Racey form the basis of her project.

"This project fits well with what the HQP Scholarship is about—research-industry connections as well as training highly qualified personnel to work within the industry," says Racey.

This past fall, Racey and her team conducted focus groups in six schools around Guelph to better understand what students in this age group already know about healthy eating, their barriers to dairy product intake and how they like to learn. She hopes this will maximize the effectiveness of her programs, to be implemented in the schools next year.

Long-term evaluations of this project will be crucial, she says. Drawing on the results of previous interventions with school-aged children, Racey found that a big problem has been a lack of long-term follow-up to evaluate changes.

"We want these programs to have long-lasting benefits," she says. "That's why there is such a strong interactive component—we want to enhance student engagement through more integrated learning."

—Alexandra Sawatzky

Racey's advisory committee consists of Profs. Genevieve Newton and Alison Duncan, HHNS; Prof. Michelle Preyde, Department of Family Relations and Applied Nutrition; Bronwynne Wilton, knowledge mobilization program manager with the Office of Research, Agri-Food and Partnerships; and Tom Wright, dairy cattle nutritionist at OMAFRA. Racey also receives additional support from Prof. William Bettger, HHNS.

The HQP Scholarship Program is funded through the OMAFRA – U of G partnership.

What's it like to be a student veterinarian?

Ontario Veterinary College's externship blog project paints a realistic picture

When Ontario Veterinary College (OVC) student veterinarian Lindsay Oxby writes in her blog that "palpation is not easy," she's not kidding. Palpation, used to diagnose pregnancy in cows, relies significantly on touch. Participants insert their arm into a cow's rectum, retract the uterus and feel for a pregnancy.

It's not a skill that you can learn from a book, but it's vital to large animal veterinarians. Eventually, the OVC externship students learn how to do it well, with a lot of time and practice.

Last year, readers had an opportunity to follow Oxby and four others through the OVC Externship Project, which was designed by OVC communications staff to show followers what it's like to be a student veterinarian.

Externships have been part of the Doctor of Veterinary Medicine (DVM) curriculum at the Ontario Veterinary College for more than 30 years and are mandatory for DVM students entering their fourth year of studies. Students complete an eight-week externship in a mixed practice setting—companion and food animal, or companion and equine.

The externship helps students transition from the academic environment to the practical setting of veterinary medicine. They learn to be members of a team providing care to animals, knowledge in client relations, practice management and technical problem-solving skills.

"Veterinarians make significant contributions to the agricultural field, food animal production, access to safe local food, and food security and exports," says OVC dean Elizabeth Stone. "During their externships, students work shoulder-to-shoulder with practising veterinarians. They learn about the breadth of life in a rural practice, from client interactions to practice management, and how to provide the best possible preventive, diagnostic and treatment solutions for both the animals and the owners."

The externship blog follows students through this practical experience. Future students as well as staff, faculty and the community learn exactly what takes place in a veterinary externship.

In 2014, Oxby and Chelsea Allan, Jodi Boyd, Michael Brown and Jeremy Shaba provided one blog each per week to the project. OVC communications staff posted the blogs to the OVC website at ovc.uoguelph.ca/externship and shared them through OVC's social media (Twitter and Facebook). In their blogs, the students not only described their experiences but also shared photos from surgeries and checkups, and submitted videos for viewers to watch.

OVC communications staff Jane Dawkins and Karen Mantel say the project proved to be an effective way to show the public what goes into educating a veterinarian and gave insight into the broad range of areas in which veterinarians play an important role.

In addition to highlighting the externship course, the project has been a good opportunity for students to practise the communication and social media skills they will use in their veterinary careers. The 2015 externship project will launch this summer with more student veterinarians sharing their experiences.

—Mallory Kohn

The Veterinary Clinical Education Program is funded by the OMAFRA – U of G partnership.

Chelsea Allan (left) and Lindsay Oxby

PHOTO: BARRY GUNN

Unpacking consumer preferences for local

Market intelligence helps producers make profitable decisions

Price is an important factor in purchasing decisions, but consumers are also showing increasing interest in how their food is produced and distributed. More people are choosing products that are grown, packaged and processed close by—indicating the high value given to local, fresh foods.

Prof. John Cranfield

PHOTO: SPARK

Helping Ontario's agri-food sector capitalize on these opportunities in both local and organic foods is Prof. John Cranfield, Department of Food, Agricultural and Resource Economics. He's aiming to improve the alignment of these marketing channels with consumer preferences.

"Understanding the nature of consumer demand will enable producers to position their products in appropriate markets at competitive prices," says Cranfield. "In turn, this will encourage more producer-initiated value chains that encompass the growth and distribution of local and organic foods."

Cranfield used an online survey—distributed to more than 2,000 people across Canada—to gain a better understanding of the factors affecting purchase decisions for five products: Gala apples, tomatoes, cheddar cheese, whole wheat bread and pork tenderloin. Questions were posed to determine the trade-offs and rationale behind consumers' food choices.

Respondents selected their preferences based on a number of key attributes, including type of production system, price, distribution channel and distance between location of production and the consumer.

According to the survey, consumers said they were willing to pay a higher price—a premium—for certified organic foods, compared to conventionally produced or uncertified organic foods.

Organic certification in Canada is strictly regulated and requires producers to be verified by an accredited organization. Often, the certification process is costly and time-consuming, so many farmers may produce with organic methods without being officially certified.

"Taking premiums for certified organic products into account, organic producers who are currently uncertified can more accurately weigh the opportunity costs of certification," says Cranfield. "This will enable more informed decisions about whether the benefits of certification would outweigh the cost of the process itself."

Interestingly, results also showed that respondents were more apt to buy locally produced or organic foods if they were available at larger grocery chains, as opposed to alternative distribution channels such as farmers' markets. This opens up potential opportunities for independent producers to successfully situate themselves either within or alongside larger mainstream distribution channels for better consumer access.

"By refining market intelligence, we can dig deeper to unpack the nuances that influence consumer demand," says Cranfield. "Opportunities are presented to Ontario's agricultural producers and distributors to establish more successful value chains that anticipate the needs of consumers and foster economic growth."

—Alexandra Sawatzky

Cranfield conducted his research in collaboration with Prof. Michael von Massow, School of Hospitality, Food and Tourism Management, who provided expertise regarding Canadian food value chains, and two graduate students in the Department of Food, Agricultural and Resource Economics, Kelvin Tsang and Yihong Zheng.

This research is funded by the OMAFRA – U of G partnership.

Enhancing competitiveness and self-reliance for farmers

Business risk management programs (BRM) provide tools for agricultural producers to manage production and price risks in a way that enhances their competitiveness and self-reliance. Prof. Rakhal Sarker (centre), along with research assistants Shashini Ratnasena (left) and Farzana Rasna, has joined forces with the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) to develop a better understanding of how BRM programs support Ontario producers.

PHOTO: MARTIN SCHWALBE

LISTEN UP

Eco-friendly cell technology is rolling your way

Your cellphone may be on its way to becoming a lot "greener," thanks to researchers at the University of Guelph. Currently, Canada is home to more than 27 million cellphones. Most have a lifetime of a few years. Those that have outlived their usefulness pose a significant environmental burden: their huge numbers deplete non-renewable resources used in their manufacture, and disposal eats up landfill space.

Now, researchers at the University's Bioproducts Discovery and Development Centre have teamed up with the School of Engineering to produce eco-friendly, biodegradable electronics from crop residues.

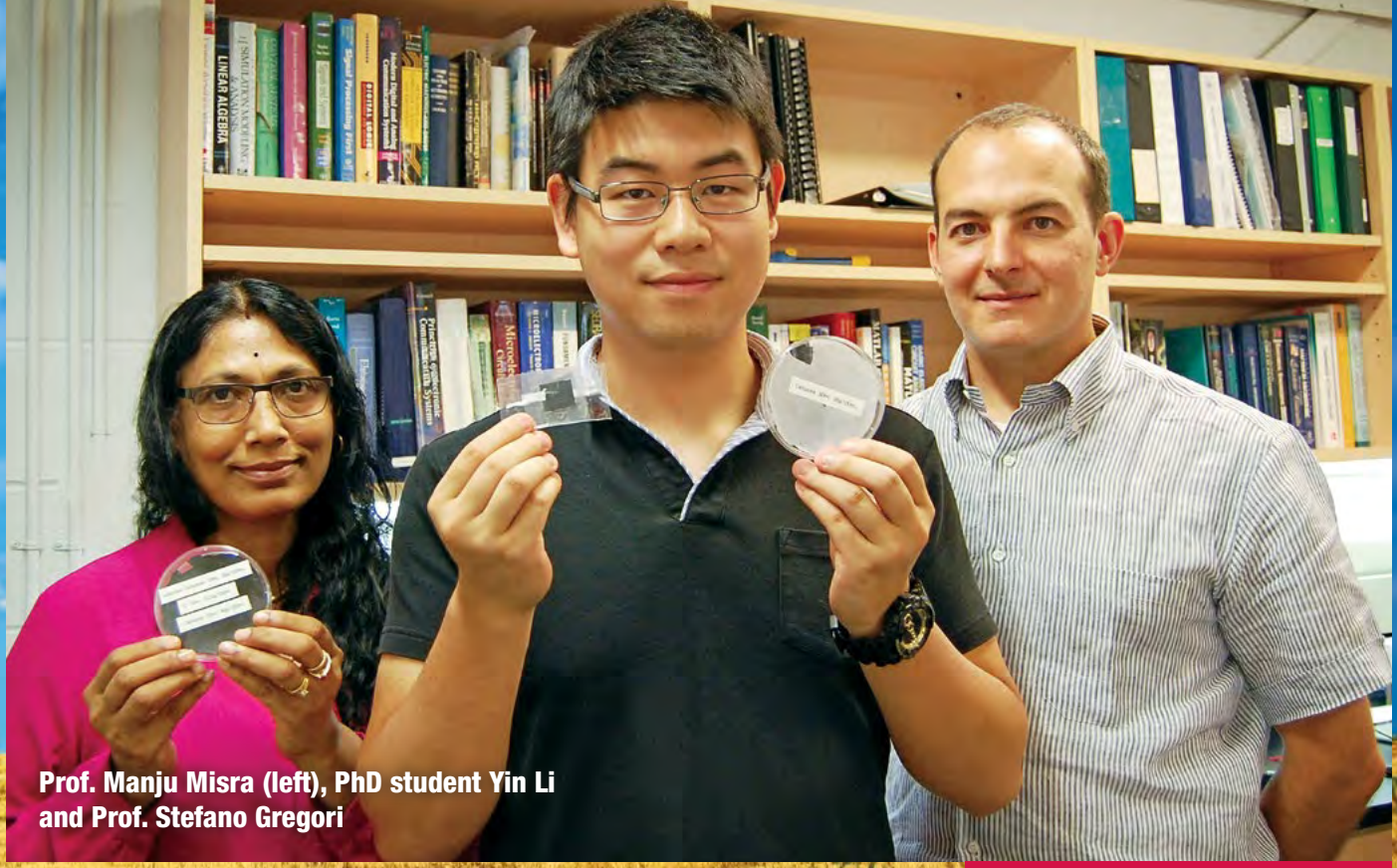
Headed by Profs. Manju Misra and Amar Mohanty, both cross-appointed to the Department of Plant Agriculture and the School of Engineering, and engineering professor Stefano Gregori, the team is developing "system-on-foil" devices for energy harvesting and storage, made from nanocellulose-carbon nanocomposites.

Cellulose is an abundant molecule found in all types of vegetation. Specifically, the researchers are using cellulose isolated from agricultural waste such as switchgrass, soy stalks, wheat straw and corn stover.

They coat the cellulose in carbon to increase its ability to conduct electricity.

"A huge amount of cellulose is available," says Misra. "It is renewable, compostable, lightweight and strong. All these factors became driving forces to use it as the material for our project."

The nanocellulose energy devices work by harnessing energy from the environment—such as human motion or vibrations—and converting it into electrical energy. They are ideal to supply small low-power electronic devices that



Prof. Manju Misra (left), PhD student Yin Li and Prof. Stefano Gregori

PHOTO: SPARK; SHUTTERSTOCK

don't always need to be turned on (such as the pressure sensors in car tires) or disposable devices, such as smart packaging systems for foods and pharmaceuticals.

"The electronic devices of the future will be thin, light, flexible and green," says Gregori. "The nanocellulose systems on foil will meet the need for green information technology, because they are integrated at the microscale, eventually becoming a seamless part of portable devices, signage, commercial packaging, wearable technology, and medical and implantable devices."

For larger electronic devices such as smartphones and tablets, the team is developing rechargeable batteries that feature nanocellulose components. Replacing some of the traditional petroleum-based materials with "green" biomaterials will reduce battery weight and costs without sacrificing performance.

The team has also set its sights on developing a cellphone in which a nanocellulose energy harvester and a green battery would be integrated into the cellphone case. The harvester would collect energy from human movement and use this energy to recharge the battery. In effect, this would allow you to charge your eco-friendly phone as you walk or run.

Mohanty says that the development of green batteries will improve the use of biomass-based materials and increase the value of cellulose. That means agricultural non-food biomass might become useful for producing cellphones and other electronic devices. The project will also help provide new industrial applications in the field of green technology and increase the competitiveness of Canada's green manufacturing industry.

— India Annamanthadoo

This research is funded by the OMAFRA – U of G partnership.

Graduate student Yin Li was recently awarded the Italian Packaging Technology Award for his research on nanocellulose energy harvesters. The award offered him an opportunity to travel to Italy to learn about new manufacturing systems and to visit Italian research centres and industries. He also established connections with companies interested in the nanocellulose energy harvesters for smart packaging systems that measure, store and transmit attributes of the product and the surrounding environment.

How much yellow is too much?

Yellow pigments in corn gluten meal affect fish flesh pigmentation

When it comes to fresh fish in grocery store display coolers, colour is the first thing consumers see.

Consumers prefer salmon, trout or char when the flesh is predominantly red or pink. They associate these colours with freshness, higher quality and better flavour. And this makes flesh colour, or pigmentation, an extremely important consideration for aquaculture producers.

Flesh colour is greatly influenced by feed. And anecdotal evidence from feed manufacturers suggests that corn gluten meal, a popular ingredient in fish feed, with its high level of yellow pigments, may be promoting suboptimal pigmentation in salmonid fish. Corn gluten meal is a high-protein, highly digestible feed ingredient widely used in diets for salmonids.

Prof. Dominique Bureau, Department of Animal and Poultry Science, and post-doctoral researcher Patricio Saez examined the effect of corn products rich in yellow pigments, such as corn gluten meal and DDGS, on the colour of rainbow trout. They wanted to know how much corn product could be included in fish feed without affecting flesh pigmentation, says Bureau. Typically, gluten meal produced through a wet milling process yields 200–550 ppm of colour pigments such as lutein and carotene.

Preliminary results suggest that feeding fish more than 12 per cent corn gluten meal and its associated yellow pigments can impair flesh pigmentation.

Typically, producers feed their fish diets that contain five to 25 per cent corn meal gluten. But preliminary results suggest that including more than 12 per cent corn gluten meal and its associated yellow pigments can impair flesh pigmentation.

"Given the high cost associated with obtaining a flesh colour that has high consumer appeal, this potential interference by corn gluten meal is not something that should be overlooked," says Bureau.

As well, he believes more fundamental research is needed to understand the mechanisms involved and to clarify the exact role played by yellow pigments or other components of corn gluten meal.

Early indications hint at the possible reduction of yellow pigments through enzyme-enhanced bleaching of corn and corn by-products. The cost effectiveness of these processes will be required to determine their industry feasibility.

Collaborating on this study were Martin Mills and Agriculture and Agri-Food Canada.

This research is funded by the OMAFRA – U of G partnership.

PHOTOS: ISTOCKPHOTO

Technician Dorota Grzadkowska detects bacteria in water samples at the Agriculture and Food Laboratory.

PHOTO: SPARK

Clean standards for agricultural processing

Maintaining a safe water supply in agricultural processing is crucial to the marketability of food products and to Ontario's reputation in domestic and international markets.

In the nearly 15 years since the Walkerton tragedy—a fatal *E. coli* contamination of the water supply in the Ontario town—the Ontario government has set in place a rigorous drinking and industrial water testing program to prevent a similar disaster from happening.

That's where the water testing facility at the Agriculture and Food Laboratory (AFL), University of Guelph, comes in. The AFL is a not-for-profit facility that provides specialized laboratory services for the Ontario government, the food, beverage and environmental industries, and other public- and private-sector clients.

Scientists at the water lab ensure that water from food and agricultural processing, as well as small water systems, upholds a level of quality that is safe for consumption or recreation.

"Ontario learned the lesson from Walkerton, that paying attention to all the quality aspects of testing is critical," says Lynne Fruhner, manager at the AFL. The water lab maintains its licence for drinking water microbial testing under the Ontario Safe Drinking Water Act.

Microbiological water testing is performed for small water systems (such as wells) that are outside of a municipal water system. The AFL also provides water testing for provincially inspected meat, dairy, fruit and vegetable processing plants. Food products bring contaminants to processing plants from their environment. Water quality testing in these plants is just one of the measures used to monitor the safety of these products.

To test water samples, the AFL uses a filtration system in which any bacteria present are collected onto a membrane filter and incubated for 24 to 48 hours. Technicians then look for the presence of target bacteria. The lab determines a total bacterial count in the sample that measures the amount of bacteria per volume of water (a high count usually indicates poor water quality). As well, they may determine the number of yeast and mould organisms using a count technique.

Most often, they're searching for indicator organisms such as *E. coli* and coliforms. Ontario has a zero tolerance rule for drinking water, meaning there cannot be any coliform or *E. coli* in a 100 mL sample of water.

"If we test the water and it is positive for coliform or *E. coli*, then it's possible that the water source is contaminated with pathogens," says Dorota Grzadkowska, the lead technician in the water lab.

At that point, the lab conducts further tests to detect the specific pathogens present. Although water testing is standardized across the province, the labs at the AFL have an unmatched breadth of expertise. Staff are equipped to quickly handle the possibility of an outbreak, and to provide the most accurate and timely results to clients and the public.

"The water testing we do for OMAFRA and other public- and private-sector clients is an important contribution to the safety of Ontarians," says Fruhner.

—India Annamanthadoo

The AFL receives funding from the OMAFRA – U of G partnership.

Dealing with porcine epidemic diarrhea virus

Preparation and biosecurity limit disease spread

Ontario's major animal disease challenge of 2014 was the introduction of porcine epidemic diarrhea virus (PEDV) to Canadian hog farms from the United States. PEDV spreads quickly via swine manure, is highly contagious and causes up to 100-per-cent mortality among suckling piglets. It is not a risk to human health, other animals or food safety.

Ontario's index case was identified on a farm Jan. 22, 2014. Sixty-three infected herds were documented by summer 2014 and approximately 13,000 PEDV tests (including environmental tests) were conducted by the University's Animal Health Laboratory (AHL). By contrast, the U.S. had experienced about 7,000 cases involving the death of seven million piglets. PEDV was a challenge for Ontario's pork industry, but the situation could have been much worse.

Advance knowledge of the virus and quick action by Ontario's agri-food sector, including the AHL, are credited with keeping the disease in check.

"Given the amount of traffic that goes on between us and the United States, it was only a matter of time until it entered Canada," said Grant Maxie, director of the AHL. "With the data seen by OMAFRA (concerning the northerly spread of the virus toward the Canadian border), we were expecting it and were prepared with a multiplex real-time PCR test." The AHL had already validated the test, making it ready for use, and shared it with labs across Canada.

In Ontario, the AHL, OMAFRA, the Ontario Association of Swine Veterinarians, Ontario Pork and the Canadian Food Inspection Agency combined their efforts to distribute information about PEDV, outlining precautions to be taken by pork producers across the province. The goal was to limit the spread of the virus through stringent biosecurity measures. These measures included improved on-farm biosecurity, such as restricted entry to barns and the use of cleaned and disinfected trucks to keep the virus out.

Farmers, livestock transporters and other industry professionals were encouraged to increase and enforce these precautionary measures. And they did, keeping losses to a minimum.

Maxie says producers, transporters and suppliers should maintain their strict observance of biosecurity to continue limiting the spread of the virus.

—Maritza Vatta and Michelle Linington

For more information on controlling PEDV, visit these websites: goo.gl/FWMkbO (OMAFRA PEDV advisory) goo.gl/KysT0B (AHL Lab Note about PEDV testing)

PHOTO: ISTOCKPHOTO

The AHL receives funding from the OMAFRA – U of G partnership.

Prospering from social media

"Community of practice" is a good way to learn from each other

As the use of social media expands, farmers have the opportunity to help their businesses grow, connect with peers and become more informed about the latest and best practices for their farming activities. Researchers are helping farmers make social media work even more effectively for them by developing an online community for farmers who share a common interest.

Prof. Michael von Massow, School of Hospitality, Food and Tourism Management, and Adrienne De Schutter, Ontario Ministry of Agriculture, Food and Rural Affairs' (OMAFRA) skills and training adviser, collaborated to provide farmers with a social media "community of practice" (CoP) focused on farm-based value-added activities.

The CoP complements OMAFRA's training initiative, called Exploring Value-Added Opportunities, a one-day workshop and e-learning program.

"The particular interests of farmers can be addressed specifically by creating a social media community of practice," says von Massow.

The CoP was initiated when researchers created and moderated Twitter, Facebook and LinkedIn pages for industry advisers, specialists and farmers who wanted to communicate online and share knowledge related to value-added activities. Individuals who took part in the Exploring Value-Added Opportunities workshops or e-learning program and those already involved in value-added activities participated in the CoP.

De Schutter found that LinkedIn was the platform best suited for generating discussion regarding value-added activities.

Von Massow says the greatest potential for communities of practice may be among learners who meet in live events, such as workshops or webinars. "Social media appears to have more potential if individuals meet in person first and then continue a relationship online," he says. "It's hard to create a social media community among strangers."

De Schutter supports that. She says that creating a private forum to connect farmers online who have met in person through workshops or blended learning programs gives participants more freedom to share their thoughts with a group of people they are more likely to trust.

—Mallory Kohn

This research is funded by the OMAFRA – U of G partnership's Knowledge Translation and Transfer Program.

PHOTOS: SHUTTERSTOCK / SCREEN CAPTURE

Prof. Lucy Mutharia (left) and undergraduate researcher Andrea Roebuck

Allied amoebas

These microscopic organisms trap and track harmful bacteria

PHOTO: MARTIN SCHWALBE

Tracking harmful bacteria in the environment is critical for preventing and managing microbial infections such as Johne's disease, a fatal intestinal infection of cattle and other ruminants. Yet current identification strategies fail to provide timely information about the environmental prevalence, distribution and persistence of these pathogenic bacteria.

That's why molecular and cellular biology (MCB) professor Lucy Mutharia, master's student John McLean and undergraduate project student Andrea Roebuck are developing an amoeba-based surveillance system that could prove to be critical in tracking live pathogens and preventing outbreaks of bacterial diseases. Their system uses amoebas—microscopic organisms that feed on bacteria—as traps to detect pathogens persisting in dairy farms as well as in fisheries.

In particular, Mutharia's research focuses on trapping *Mycobacterium avium* subspecies *paratuberculosis (*MAP), the agent that causes Johne's disease.

Although MAP is known to grow only within a host—usually, within animal cells—it has been isolated from manure, soil and pasture samples.

MAP can resist being killed by amoebas and instead use them as a host in which to proliferate, much as they would use an animal cell. These amoeba-resistant bacteria are often pathogenic. To Mutharia, this trait means amoebas themselves could be used to trap the pathogens.

The first challenge in the research was to develop a way to isolate the amoebas from complex samples that include many organisms, such as manure. McLean was able to isolate the amoeba and in doing so, uncovered some interesting observations on the interactions between bacteria and their amoeba hosts. For example, he found bacterial survival in an amoeba is species-specific. It depends on the species of amoeba and the strain of harmful microbes involved.

Mutharia's lab is applying this knowledge to develop pathogen detection methods based on isolating amoebas from target environmental samples. According to this plan, amoebas would be planted into an environment to capture bacteria and later isolated in a lab. Then, any bacteria present inside the amoebas would be cultured for identification.

Identification of these bacteria would provide concrete evidence of the presence of live MAP or other pathogens. The current identification strategy, which uses bacterial DNA, only indicates that the bacteria were present at one time or another, but not whether the live bacteria are still there.

To farmers, this means MAP's presence could be identified sooner, to help stop the spread of Johne's disease.

"Once we have identified sources of the live bacteria, we can look at what mitigating steps must be taken," says Mutharia. "Identifying pathogen environmental reservoirs is one of the strategies for effective management of Johne's disease."

Furthermore, Mutharia says that this amoeba-trap protocol could be extended to other situations involving pathogen detection, such as in sewage runoff.

—India Annamanthadoo

Collaborators include MCB professor Roselynn Stevenson.

This research is funded by the OMAFRA – U of G partnership.

Hopping to it

Researchers begin disease prevention program for Ontario's commercial rabbits

Ontario's commercial rabbit industry provides an important alternative source of meat, particularly as the province's ethnic diversity evolves. The industry is taking measures to meet this growing demand, including attention to disease control.

PHOTO: SHUTTERSTOCK

Pathobiology professor Patricia Turner is leading a research team committed to developing a user-friendly set of biosecurity recommendations. The team consists of pathobiology professors Scott Weese and Patrick Boerlin; Prof. Scott McEwen, Department of Population Medicine; Marina Brash, Animal Health Laboratory; and Richard Reid-Smith of the Laboratory for Foodborne Zoonoses at the Public Health Agency of Canada.

"We want to help producers develop the capacity to improve productivity and animal well-being," says Turner.

At the core of this project, researchers will evaluate the prevalence of common and emerging bacterial and viral enteric pathogens, as well as levels of antimicrobial resistance in Ontario commercial rabbits.

One challenge is that disruptions to bacterial populations within the gut microflora of rabbits can provide a breeding ground for new diseases, particularly enteritis or inflammation.

If not managed properly, enteritis can lead to significant production losses in the industry—as much as 35 per cent in young rabbits.

"In addition to the financial losses borne by producers, there are significant welfare issues and food safety risks," says Turner.

Preliminary studies on enteritis in North American rabbits have identified bacterial and viral strains that could be infectious to other farm animals as well as humans.

However, few resources are available to track and treat these enteric pathogens. In fact, until very recently, only one drug was approved to treat diseased rabbits.

And due to its extensive use, resistance to this drug is increasing throughout the industry.

With this in mind, Turner is working with graduate student Jennifer Kylie to study the fecal microbiomes of different rabbit populations, hoping to understand how antibiotics alter their gut flora and possibly predispose them to infection.

Another issue the researchers are studying is hygiene protocols, which Turner notes require stronger enforcement within the industry in order to reduce the prevalence of infections. Current practices are often quite variable between farms, and there are no codes of practice for transporting breeding stock between locations. Inconsistent hygiene standards combined with mixing populations of rabbits often leads to cross-contamination, providing pathways for disease to spread.

"Producers need to know they can improve levels of biosecurity in simple, inexpensive ways that have profound benefits for the entire industry," says Turner.

Small changes can have significant impacts. Changing boots and outer clothing when leaving the barn, disinfecting crates after shipping, and removing manure and urine more frequently all help to control the spread of pathogens, and raise the levels of biosecurity on farms.

Overall, Turner says results from this study will help identify ways to prevent complications before they arise. This, combined with efforts to strengthen the overall organization of Ontario's commercial rabbit industry, will help guide better methods of disease prevention and control.

—Alexandra Sawatzky

This research is funded by the OMAFRA – U of G partnership. Additional funding is provided by Ontario Rabbit, Floradale Feed Mill and B-W Feed and Seed Ltd.

Inside the Gryphon's LAAIR

Where great ideas become new products and businesses

Great ideas start in the lab and the field…but then what? Sometimes they need a little extra help to get into the market. That's where the Gryphon's LAAIR (Leading to Accelerated Adoption of Innovative Research) funding program comes in.

The Gryphon's LAAIR is designed to mobilize cutting-edge technologies developed by University of Guelph researchers to market.

"We tried to design a program that provided bridge funding to help researchers get their ideas to the next stage of commercial development and help them close the gap between the lab and the marketplace," says Rich Moccia, associate vice-president, research (strategic partnerships), who worked with a team to develop the Gryphon's LAAIR program two years ago. "The uptake by our researchers has been exciting, and they are getting to develop and practise business skills that will aid in the transfer of technology to the benefit of society."

This year, the program's commercialization fund offered two funding streams — one for early development or market discovery projects (up to $25,000) and the other for larger, more mature projects (up to $125,000 per project).

In the spring, finalists chosen for the commercialization fund presented their research ideas in a *Dragons' Den*-style investment pitch to a panel of industry stakeholders and investment professionals known as "the Gryphons."

In total, five of the large projects (described here) received commercialization funding for their innovative technology and potential for industry adoption, as well as 10 smaller ones.

—Alaina Osborne

The Gryphon's LAAIR program is supported by the OMAFRA – U of G partnership and Growing Forward 2 (GF2), a federal-provincial initiative.

Beef cattle could benefit from Immunity+™

Respiratory disease is the most costly health issue in the beef cattle industry. Currently, vaccines and antibiotics are the main methods used to combat the disease. Prof. Bonnie Mallard, Department of Pathobiology, is investigating how selective breeding might help prevent the ailment.

In collaboration with Semex Alliance, Mallard created an immunity testing technology that detects high immune responders and is used by Semex to sell bovine semen under the brand name Immunity+. This technology allows for the selective breeding of dairy cows with high disease resistance.

Now, Mallard wants to focus on improving the genetics of beef cattle. Her technology could reduce the need for antibiotics and improve animal welfare by reducing cases of disease.

Probiotics for pigs and other livestock on the horizon

The specific composition of bacteria in an animal's gastrointestinal tract can help the animal gain weight and fight infection, says Prof. Emma Allen-Vercoe, Department of Molecular and Cellular Biology. She's developing a mixture of probiotics specifically designed to help improve the functioning of the pig GI tract.

Due to limited diets and the use of antibiotics, the diversity of bacteria in pigs' GI systems is low and vulnerable. Probiotics that can easily be incorporated into feed could replace the drugs needed to combat GI disease and dysfunction, reduce antibiotic resistance and improve production efficiency.

In the future, these probiotics could be developed for other livestock species, including cattle and poultry.

Background photo: close-up of 3-D printer

Cheers to Ontario craft beer . . . and local yeast

Canadians are increasingly seeking a variety of styles of beer. Different types of yeast influence the properties of the final product. Prof. George van der Merwe, Department of Molecular and Cellular Biology, is discovering strains of yeast that could enhance flavours and aromas for consumers.

Van der Merwe and his team have identified yeast strains from Ontario, allowing local microbreweries to become more competitive with more novel products.

This research could also lead to increased employment within the craft industry. These yeast strains might also be used to make cider.

These plants start with a 3-D printer

Bioreactors are purpose-built vessels used to efficiently grow and multiply plant cells under controlled conditions. However, this technology is costly and is not designed to cater to a specific variety of plants.

Prof. Max Jones, Department of Plant Agriculture, is using 3-D printing technology to make bioreactors. These bioreactors would give Ontario producers a more cost-effective, local system for growing a variety of ornamental, fruit and nursery plants more quickly.

Improved bioreactors would enable more local plant propagation by reducing industry reliance on imports and would provide Ontario growers with high-quality and disease-free plants.

Robots for more efficient greenhouses

Canada's greenhouse industry in Canada is competitive, but it needs a large amount of labour to operate. Competition across the country has prompted researchers to find ways to lower labour costs.

Now, Prof. Medhat Moussa, School of Engineering, is developing robot technology – called the Guelph Intelligent Greenhouse Automation System (GIGAS) – to improve production efficiency in vegetable greenhouses. These robots will harvest vegetables and de-leaf plants by mimicking human hands – but with even greater precision.

GIGAS uses infrared cameras, advanced robotics and big data analytics to pinpoint the time to harvest certain vegetables such as tomatoes.


Prof. Bonnie Mallard


Prof. Emma Allen-Vercoe

Gord Surgeoner


John Webb


Don Stewart and Patricia Folkins

Among the researchers proposing ideas in the most recent Gryphon's LAAIR competition were (from top) Profs. Bonnie Mallard and Emma Allen-Vercoe, who presented their ideas to judges Gord Surgeoner, John Webb, Don Stewart, Patricia Folkins and Adi Treasurywala (not shown).

PHOTOS: MARTIN SCHWALBE · 3D PRINTER: SHUTTERSTOCK

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