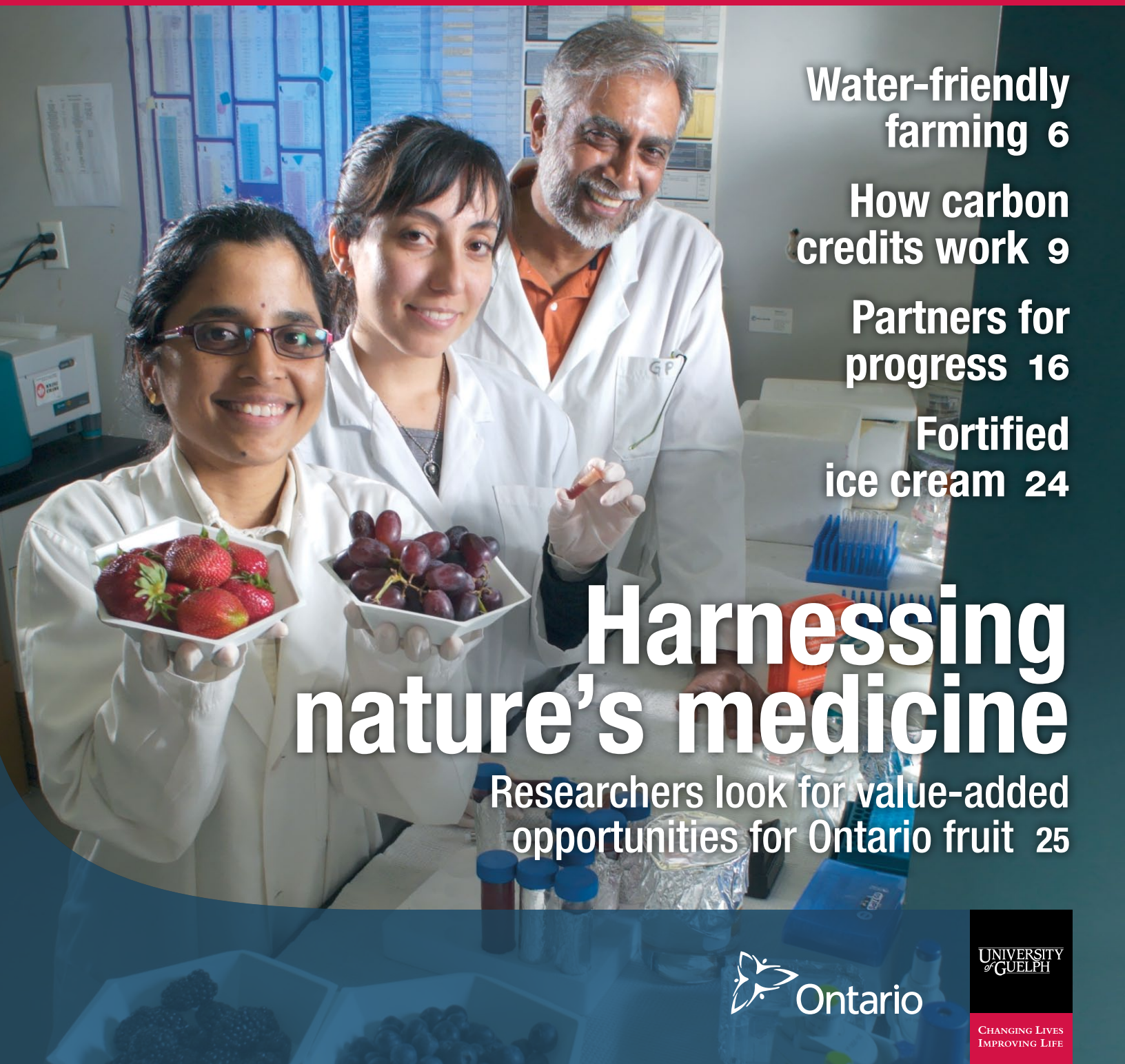
OMAFRA–University of Guelph Partnership

Volume XXV Number 2 Fall 2010

Research magazine

2010 Agri-Food Yearbook Edition



Harnessing nature's medicine

Researchers look for value-added opportunities for Ontario fruit 25

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Opening doors to opportunity

The province's five-year Open Ontario Plan is opening doors for our agri-food sector and rural communities. At the same time, the partnership between the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) and the University of Guelph (U of G) is taking advantage of emerging global opportunities. Together, these two initiatives represent a powerful combination of science, innovation and practical application that is driving greater investment and job creation in Ontario, while protecting our health and environment.

After two years, the renewed partnership agreement is exceeding expectations. We are forging ahead in this province's quest for greener products; hardier crops and healthier livestock; more nutritionally beneficial foods; and more rapid disease detection. We're making inroads towards better understanding the complexities of everything from entire ecosystems to the tiniest microbes. The partnership's new Highly Qualified Personnel (HQP) graduate training program will help tomorrow's industry leaders tap the business possibilities of this new knowledge.

The investment is yielding an excellent return, leveraging other partners' contributions to create an internationally recognized cluster of agri-food expertise, and economic returns for Ontarians. The Agricultural Research Institute of Ontario's 14 agricultural research stations across the province and three regional U of G campuses add up to an effective package of people and places to produce results.

In these pages, you will find an impressive collection of highlights from the important work being done under the partnership agreement. We are pleased to share these stories, and congratulate everyone involved.

HON. CAROL MITCHELL
Minister of Agriculture, Food and Rural Affairs

ALASTAIR J. S. SUMMERLEE
President and Vice-Chancellor
University of Guelph

PHOTO: GRANT MARTIN

Research magazine

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Vice-President (Research)
Kevin Hall

Associate Vice-President Research (Agri-Food and Partnerships)
Richard D. Moccia

Editor and Director, Research Communications
Owen Roberts

Editorial Advisor
Liz Snyder

Research Analyst—Partnership Liaison
Robyn Meerveld

Associate Editor and Project Co-ordinator
Hayley Millard

Copy Editor
Stacey Curry Gunn

Design
LINDdesign

Cover Photo: Martin Schwalbe

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Address correspondence to:
Owen Roberts, Director, Research Communications
Office of Research, Room 437, University Centre
University of Guelph, Guelph, ON N1G 2W1
519-824-4120 ext. 58278
rcinfo@uoguelph.ca

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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

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Contributors

The University of Guelph *Research* magazine is written and co-ordinated by students involved in the university's Students Promoting Awareness of Research Knowledge (SPARK) program.

Sustainability is the theme of this edition of *Research*. SPARK writers delved into OMAFRA–U of G Partnership research that supports economic, social and environmental sustainability. At the same time, SPARK has proven its sustainability by recently celebrating its own 20th anniversary.

Biofuel crops seem like a promising alternative to fossil fuels, but how much greenhouse gas do they actually produce? That's what **Joel Aitken**, a fourth-year agriculture student from Acton, Ont. wanted to find out in his article about the carbon cycle of biofuel crops on page 9.

The success of **Wesley Emmott**'s family dairy farm in Brantford, Ont. taught him to fully appreciate the value of creating a distinguishable product. As a fourth-year agriculture student, he also learned more about how Ontario distinguishes its food-grade soybeans. Read his story on page 10.

Third-year agricultural business student **Rebecca Hannam** grew up outside of Guelph, Ont., where her farming family taught her the importance of seeking new market opportunities in agriculture. Given recent, novel trends in healthy eating, Rebecca was interested in learning more about new milk and soybean products ideal for health-conscious shoppers. Check out her stories on pages 23 and 26.

Tony Meekes, a third-year agricultural business student, takes a keen interest in using biomass for energy. Growing up on a cash-crop farm in Northumberland County, he and his father have investigated various methods for producing biomass. On page 8, you can read what Tony discovered about research directed to growing biomass in northern Ontario.

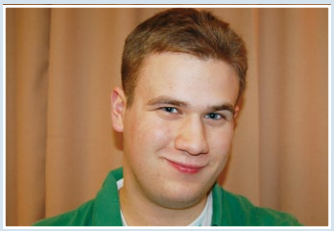
Fifth-year agricultural economics student and Ridgetown, Ont. native **Alycia Moore** claims she ate brown bread before it was cool. While her classmates munched on Wonder Bread sandwiches, Alycia was already aware of the benefits of adding fibre for a more balanced diet. Now she's learned she can have her cake (well, ice cream) and eat it too, as scientists have been working on fibre-fortifying some of our favourite dairy products. See this story on page 18.

On the farm in Sussex, New Brunswick, fifth-year animal science student **Carol Moore** learned first-hand how to take care of animals. Giving them nutritious food and clean water kept them healthy, and in return they produced healthy products. She writes about research that is taking a more in-depth look at this correlation on page 13.

Growing up outside Guelph, Ont., **Natalie Osborne** used to gather leftover stalks on her family's soybean farm, thinking she could spin them into gold like Rumplestiltskin did. Now in her second year of biomedical sciences, she's learned researchers are doing just that by turning soy by-products into economic, environmentally friendly plastics for safer food packaging. See her story on page 12.

The Ford Motor Company is starting to use agricultural products in alternative ways. For example, the company has created an interior storage bin from wheat straw-based bio-plastic. Recent agriculture program graduate **Jeremy Parkinson**, who hails from a cash-crop and sheep farm near Fergus, Ont., got the inside scoop. Check out his story on page 10.

Harvesting biomass for heat generation while maintaining soil integrity is a challenge facing producers. Third-year agricultural economics student **Elizabeth Schouten** from Richmond, Ont. writes about how much biomass can be removed without destroying soil fertility. See page 19.



He may be a proud, life-long suburbanite, but **Joey Sabljic**, a third-year English student from Guelph, Ont., knows the toll disease outbreaks can take on farmers, and by extension, on us all. With that in mind, he learned more about the latest research in emergency disease management and prevention on pages 20 and 21.

PHOTOS: HAYLEY MILLARD

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Building **Sustainability**: Economic, Social and Environmental **Benefits**

Building sustainability in Ontario's agri-food sector and rural communities is critical for the long-term health of the province.

The partnership between the Ontario Ministry of Agriculture, Food and Rural Affairs and the University of Guelph is key to sustainability through its research, veterinary and laboratory programs. This unique collaboration, spanning more than 125 years, has provided Ontario with highly skilled expertise needed to provide cost-effective solutions for today and tomorrow.

The paybacks are enormous: increased economic activity, stronger environmental protection and improved animal and human health.

In this report, you'll see, for example, how scientists are:

- Using wheat straw to produce auto parts that are lighter and more cost-competitive.
- Improving water protection by fine-tuning computer water-use programs.
- Making Ontario berries healthier by maximizing their nutraceutical properties.
- Reducing food contamination through early detection of pathogens.

These and other stories are a small sampling of the many ways the OMAFRA–University of Guelph Partnership is contributing to local and global sustainability. The current multi-year agreement ensures that collaboration and benefits will continue into the future.

OMAFRA and the University of Guelph's environmental sustainability research theme focuses on maintaining the ability of natural resources—soil, air, water and biodiversity—to support and strengthen the agriculture, food and bioproduct sectors, and rural communities. To protect Ontario's diverse environment, researchers provide science-based direction for government policies and legislation.

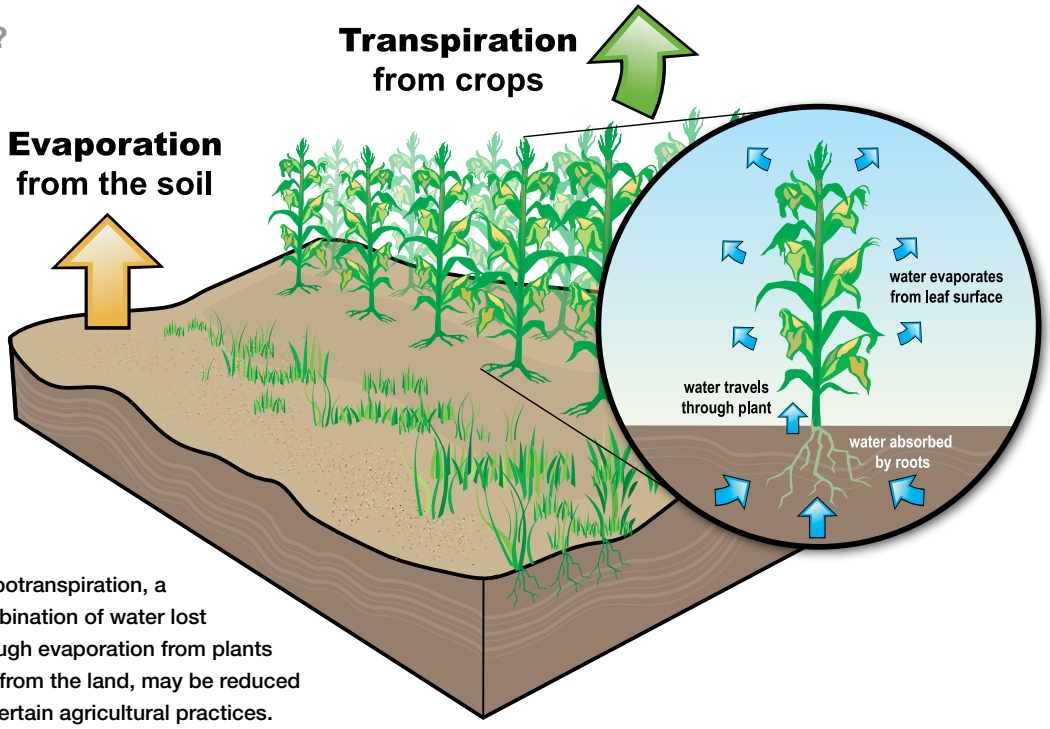
Population growth presents opportunities for new markets and challenges for agriculture and the environment. The OMAFRA–University of Guelph Partnership aims to balance the needs of people and the agri-food industry with environmental priorities in order to achieve sustainable agriculture and food production.

Water-friendly farming

Which tillage practices limit transpiration and evaporation?

BY LINDSAY BROWN

Water lost through a combination of plant transpiration—the evaporation of water from plants—and evaporation from the land's surface is called evapotranspiration. A certain amount occurs naturally, but it's exacerbated by such things as land use—especially tillage, which disturbs the soil—and a plant's normal growth. Excessive evapotranspiration can cause significant water loss, and researchers at the University of Guelph are trying to determine how to mitigate its effects.



Evapotranspiration, a combination of water lost through evaporation from plants and from the land, may be reduced by certain agricultural practices.

Since 2001, Prof. Jon Warland, School of Environmental Sciences, and a team of researchers have been looking at how different agricultural management techniques affect evapotranspiration. They observed evapotranspiration in connection with conventional tillage, which involves turning over the soil with a plow, and in no-till, where the roots and lower portion of plant stalks are left in the ground.

"When developing agricultural management practices, producers should consider the type of tillage used, as it may increase or decrease the loss of water through evapotranspiration from the watershed," says Warland.

The water lost from plants during the growing season naturally affects their growth and productivity. To absorb the atmospheric carbon dioxide that is also required for growth, a plant must open up the pores on the underside of its leaves. Once the pores open up, water is lost through transpiration. The faster a plant grows, the more water it needs as an increasing amount is lost through the pores.

Warland and his research team measured evaporation and transpiration year-round at 30-minute intervals. They positioned measurement instruments called an eddy covariance system a few metres above the plants or crops. Overall, a no-till environment improved water conservation because of the improved soil structure, and there was no significant reduction in yield.

- Research collaborators include Profs. Claudia Wagner-Riddle and Gary Parkin, Land Resource Science; Prof. Aaron Berg, Geography; and PhD candidate Nasim Alavi.
- This research is funded by the OMAFRA–U of G Partnership. Additional funding is provided by the Canada Foundation for Innovation and the Natural Sciences and Engineering Research Council.

ILLUSTRATION: BRANDON DENARD

Next: The local water movement

Creating Ontario-specific models will better protect the province's water sources

BY ARTHUR CHURCHYARD

Prof. Ramesh Rudra and his team are using computer models to better keep our water sources safe and clean.

Incorporating Ontario-specific information into computer programs used by water planners would help better predict local water quantity and quality, say U of G researchers.

Profs. Ramesh Rudra and Bahram Gharabaghi of the School of Engineering are dissecting existing watershed models to learn how they could be improved and adjusted to Ontario conditions. The enhanced programs could give water-resource managers better tools to keep water sources safe and clean.

"We are analyzing the strengths and weaknesses of these computer models to give Ontario water planners a reliable source of advice," says Rudra. "We hope our recommendations significantly improve the application of models for use in unique Ontario conditions."

Many of the water-planning models now used in Ontario were developed for conditions in the United States. But Rudra says a watershed model must be based on local hydrology to get the most out of it. That's why the Guelph team began studying information from the Ontario government and conservation authorities to pinpoint the unique provincial conditions that should be represented in current watershed models.

The team has found that improving current watershed models to account for Ontario hydrological conditions will greatly enhance their accuracy. Rudra notes, for example, that spring melting sends large water quantities, soil particles and pollution into streams and lakes. Quantifying these contributions during the spring will help water planners, treatment facilities and dam managers handle the extra water volumes.

He also believes the water-purifying effects of wetlands should be given more weight in Ontario watershed models. Wetlands are needed in provincial water systems as a natural way of protecting drinking-water sources and should be conserved, he says.

Water-source protection is taken seriously by environmental guardians such as the Lake Simcoe Region Conservation Authority. The authority uses a watershed model called the Canadian Nutrient and Water Evaluation Tool (CANWET). This model weighs economic costs and benefits, considers options based on social acceptability and then recommends the best management practices. These practices can sometimes be complicated, but they can also be as simple as planting a strip of vegetation beside a riverbank to prevent erosion along waterways. The Guelph Watershed Research Group has been involved in enhancing CANWET for application to Ontario conditions.

Distributed by Ontario-based Greenland International Consulting Engineers, CANWET is moving towards a user-friendly, web-based service that could be used nationwide. Greenland International is staffed largely by University of Guelph alumni and hopes to incorporate the Guelph engineers' recommendations into their models.

"Models such as CANWET aren't used just by conservation authorities," says Rudra. Governments use these models to make development plans such as Ontario's "Places to Grow" initiative, which encourages development in areas where the impact on source water will be minimal. By improving the suitability of these models, he and his colleagues in the Guelph Watershed Research Group will be improving the ability of water planners to protect water consumers from source to tap.

- This research is funded by the OMAFRA–U of G Partnership. Additional funding is provided by the Ontario Ministry of the Environment, the Ontario Ministry of Natural Resources, the Greenland International Group of Companies and Ontario conservation authorities.

- More information about the Guelph Watershed Research Group can be found at www.soe.uoguelph.ca/webfiles/watershed/Guelphwatershed.htm

PHOTO: MARTIN SCHWALBE

Plant and animal products in agriculture have long been used primarily for food and feed. The terms "bioeconomy" and "industrial uses" refer to the incorporation of renewable biomass resources—in whole or in part—into non-food and non-feed manufactured products, or energy systems. Often biomass is used to replace petrochemicals, with the benefit of making production more environmentally sustainable.

This research theme focuses on three major product categories—biomaterials (e.g., textiles, carpets and panels), biochemicals (e.g., lubricants, sealants and oil) and bioenergy (e.g., ethanol, methanol and biodiesel)—all of which involve the use of agriculturally derived biomass to reduce dependency on petroleum-based materials.

Biomass has great weight in the energy debate

BY TONY MEEKES

Biofuels are expected to grow in popularity with the ever-increasing awareness of humanity's impact on the environment, leading farmers to look at the amount and types of crops they can grow for biofuel production.

Prof. Tim Rennie of the University of Guelph's Kemptville Campus is researching the potential for growing biomass crops as an energy source. He's collaborating with Kempville researcher Ashraf Tubeileh, John Rowsell from the New Liskeard Agricultural Research Station and Profs. Anna Crolla and Chris Kinsley from Guelph's Campus d'Alfred. Kemptville Prof. Jim Fisher is studying the economic aspects of the project.

Rennie believes biomass has an advantage over many other fuel types.

"We're probably better off heating our homes with biomass instead of petroleum products, where you have higher amounts of carbon dioxide released," he says.

Providing energy for the world will take a number of sources. Biomass is not well-suited for the likes of jet fuel (which is much more energy intensive), but when it comes to low-energy uses, such as heat, Rennie says biomass is a better alternative than more common heating sources.

The challenge is to find the right crop that will prove to be a viable heating and energy source.

Rennie is also taking into account colder northern climates where there can be more challenges for farmers. In addition to cooler weather, the soil may not be as fertile as in southwestern Ontario. This makes it harder to grow high value crops, such as corn.

But many grasses seem to grow well in the north, and now Rennie and his colleagues want to determine which ones are optimal for the conditions. They need to consider yield and the energy output of each crop. They've looked at annuals such as sorghum and millet, as well as perennials such as switchgrass, miscanthus, big blue stem, and reed canary grass.

There are significant differences between each of these crops. For instance, it costs twice as much to plant an acre of miscanthus ($500 to $600) compared to switchgrass. Miscanthus yields twice as much, but still remains capital-intensive to plant.

Perennials take time to develop before they are able to be harvested but they can be harvested multiple years, saving valuable time for farmers. However, annuals provide a harvest in the initial years, taking less time to develop, and giving a return on investment right away.

With this information, farmers in northern climates will have the tools they need to participate in the biofuel movement. R

■ This research is funded by the OMAFRA–U of G Partnership as well as industrial partners

Researchers are finding biomass is best for low-energy uses such as household heating.

Piecing together the carbon credit system

It begins with life cycle analysis of on-farm greenhouse gases in biofuel production

BY JOEL AITKEN

In a high-tech plant in Windsor, Ont., engineers ponder the thousands of parts that make up today's fuel-efficient vehicle. They take every second of its life expectancy into account, from the time the minerals are blasted out of the earth, to the day the car is taken off the road and disassembled.

This detailed, piece-by-piece analysis is called life cycle analysis. It's used to understand all of the inputs and outputs of a system over its entire production cycle.

In a project jointly supported by the OMAFRA–U of G Partnership and the Grain Farmers of Ontario, Prof. Claudia Wagner-Riddle, School of Environmental Sciences, and Prof. Goretty Dias, University of Waterloo, are developing computer-modelling software for an on-farm life cycle analysis of biofuel crop production and greenhouse gas emissions.

An average corn crop, for example, has numerous inputs, including fertilizer, seeds and fuel. Each of these inputs has associated greenhouse gases that are released during their production. But crops are also part of a complex biological cycle of both carbon and nitrogen. For example, every tonne of nitrogen lost to the atmosphere as nitrous oxide is equivalent to 310 tonnes of CO_2.

Because they're so highly dependent on variable environmental conditions, weather and farm management techniques, the life cycles of crop production are difficult to analyze. The development of accurate, reliable computer models promises to improve our understanding of the connections between agricultural production and the environment.

"This software model could be used by government to estimate and compare the impacts of biofuel policies at the farm level," says Wagner-Riddle. This would fast-track the decision-making process associated with developing new biofuel production policies, and bring new market opportunities to Ontario farmers sooner, she says.

These new opportunities could come in the form of carbon credits. A carbon credit is a theoretical unit equal to one tonne of CO_2. Credits are used within what's called a cap and trade system, where a maximum allowable emission rate or "cap" is determined and credits are distributed. Carbon credits have the potential to reward farmers for the carbon sequestration services they may already be providing to society.

Determining how many credits a farm is producing and at what cost can be difficult to estimate, given the complexity and variability of farming. But computer models could help.

Wagner-Riddle's research into the on-farm life cycles of three biofuel crops—corn, willow and either miscanthus or switchgrass—is an effort to model the impact of management practices such as nitrogen application rate, as well as timing and placement of nitrogen, on the amount of nitrous oxides released from the system. The growth rate of the crop and the uptake of CO_2 will also be calculated as important inputs of the life cycle analysis.

With a thorough understanding of the system from crop planting to end fuel use and accurate models of each step in between, policy could be developed to allow farmers growing biofuel feedstock in a sustainable way to gain carbon credits that could be sold as a secondary source of income.

Profs. Claudia Wagner-Riddle (left) and Goretty Dias are developing computer-modelling software to determine the impact of biofuel crop production.

■ This research is funded by the OMAFRA–U of G Partnership, the Grain Farmers of Ontario and the Agricultural Adaptation Council through the Farm Innovation Program.

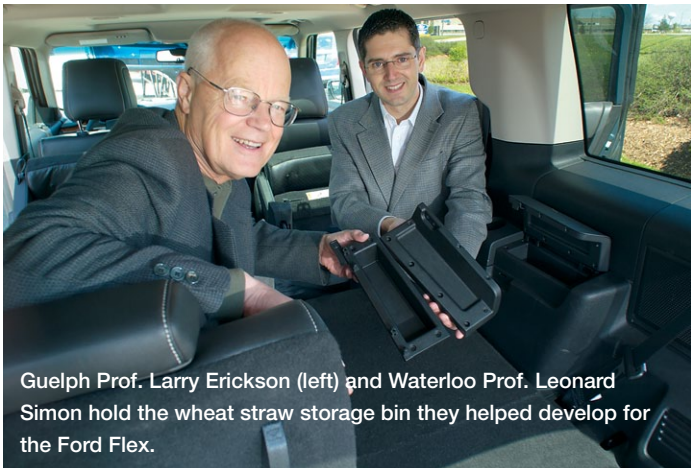
PHOTO: MARTIN SCHWALBE · OPPOSITE PHOTO: TIM RENNIE

Ford first on the market with "green" bio-bin

BY JEREMY PARKINSON

Wheat straw has taken on a new role for Ford Motor Company. The 2010 Flex, which is manufactured at Ford's Oakville, Ont. plant, contains an interior storage bin that is 20 per cent wheat straw-reinforced plastic.

University of Guelph plant agriculture Prof. Larry Erickson has seen the initial idea transformed into a car part over the past four years.



Guelph Prof. Larry Erickson (left) and Waterloo Prof. Leonard Simon hold the wheat straw storage bin they helped develop for the Ford Flex.

By all indications, this is part of a biomaterials trend. Agriculture-based materials have become attractive to Ontario manufacturers. There's a large manufacturing base in the province that produces reliable, consistent, environmentally friendly materials that aren't taken from the food chain. Such ventures could also increase profits for farmers because they open another market.

Wheat straw-based plastic could be an especially promising commodity. It's lighter than conventional plastic, which could be key for auto companies looking to make their vehicles more fuel efficient (one way to do so is to make cars lighter). Wheat straw is also cheaper than plastic, so the car part could be less costly.

Regardless of the cultivar or where it's grown, wheat straw has consistent structural properties worldwide. It's readily available, which is essential because Ford has plants all over the world and wouldn't have to set up a complicated supply chain. The company could get material locally, reduce shipping costs and make sure the assembly line doesn't run out of parts.

An average vehicle has about 200 kilograms of plastic parts. Erickson says it would be great to see motor vehicle companies replacing as much of their conventional plastic parts as possible, using bio-based plastic from agricultural crops for car seats, dashboards and door panels.

To reach this goal, however, society needs to be comfortable with bio-based products.

"We need to start in little niches," says Erickson. "For example, in the Flex storage bin, the straw is blended into the plastic so you can see it, which gives it texture and an organic look. People like that rather than bare plastic."

■ This research was funded by the OMAFRA–U of G Partnership, the Ontario BioCar Initiative, and collaboration between the universities of Guelph, Toronto, Waterloo and Windsor.

Premiums stack up for food-grade soybeans

BY WESLEY EMMOTT AND JOEY SABLJIC

Food-grade soybeans are proving that they can offer even more value to agricultural production in Ontario than soybeans grown for other purposes. While the commodity is already a leading crop when it comes to production, research at the University of Guelph is supporting the industry by looking into farmers'premium potential for food-grade soybeans.

Food, Agriculture and Resource Economics Prof. Alfons Weersink is leading a study that shows premiums for food-grade soybean growers are currently more lucrative than market expansion into other uses, such as biofuels or bioproducts.

Weersink and his research team studied identity preserved (IP) programs designed to segregate specific crops from mainstream commodities. IP programs give producers high premiums for specialty soy varieties targeted towards smaller niche markets. Growers and grain merchants can expect a premium anywhere from $1.50 to $4 a bushel for providing this service. It's a distinctly different approach than large-volume, non-IP soybeans, where there is no segregation among soy crops and all prices are determined by the Chicago Board of Trade.

Historically, Ontario's IP programs have attracted customers from around the world. For example, Japanese tofu processors have agreements with Ontario growers for white hilum soybeans, a main ingredient in tofu. The key is the white hilum; coloured hilum soybeans cause specks in the final product, making it aesthetically unappealing and not usable. The bean's colour is essential to the end product, meaning processors are willing to offer more for these specialty beans.

Weersink says new markets for soybeans, such as biofuel feedstocks, are constantly being developed. This new demand increases the prices for all soybean farmers, but new food-grade demand increases the prices specifically for Ontario soybean farmers. "In Ontario, we have the ability to segregate varieties and create new demands," says Weersink.

■ This research is funded by the OMAFRA–U of G Partnership and the Ontario Soybean Growers.

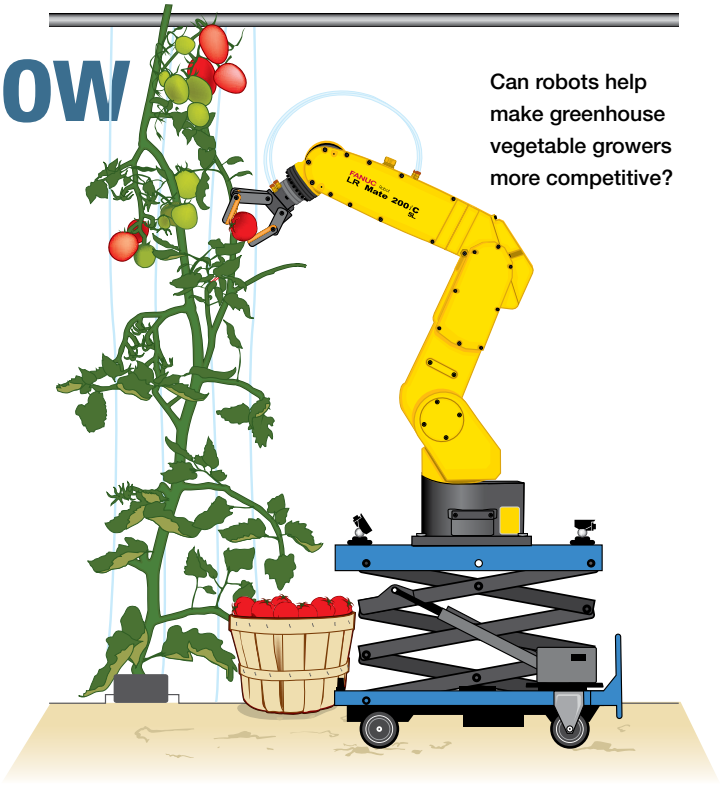
PHOTO: LEONARDO SIMON

This research theme focuses on strengthening agri-food value chains in Ontario through research to provide innovation in product development and enhancement. Businesses operating along a value chain can combine their resources and capabilities to achieve commercial success that might not otherwise have been possible.

Agri-food value chains are not limited to primary production and processing. The OMAFRA–University of Guelph Partnership supports research into other important components, including market analysis, consumer behaviour, commercialization and traceability.

Improving any or all aspects of product development can increase overall productivity, profitability and sustainability.

These robots know how to pick'em



Can robots help make greenhouse vegetable growers more competitive?

Work begins on a human-scale robotic arm for greenhouse labour

BY JEREMY PARKINSON

Robots can build cars… so why can't they pick tomatoes? That's what University of Guelph researchers want to know, as they hunt for ways to help Ontario greenhouse growers stay competitive in a rapidly growing industry.

Profs. Medhat Moussa and Hussein Abdullah, School of Engineering, are working with greenhouse vegetable growers in Leamington to develop a tomato-picking robotic arm.

Moussa envisions technology that mimics a human arm. It will have a one-metre reach, with a component called a "gripper" replacing a hand. The arm will be equipped with tiny cameras, so the robot is able to identify if a tomato is ready to be picked, and gingerly take it off the vine without damaging it.

Moussa says various technology components needed to build a robot of this calibre are available within the auto sector; however, further research and development are necessary to adapt it to pick tomatoes and other greenhouse produce. He's giving himself and his team three years to meet the challenges.

The first challenge is introducing robots to facilities that are already built to meet the needs of plants and workers. The robots will typically have two-metre-wide rows in which to move, but they'll be competing with people and other equipment. The work environment is also far more cluttered than a typical industrial facility.

Second, the speed at which robots pick tomatoes could pose a challenge.

"Building a robot which is able to identify a tomato and where it is on the plant, manoeuvring around the environment and finally actually picking the tomato off the plant, would take the robot about a minute," says Moussa. But the task must be done in seconds to compete with humans.

Finally, a robot needs to be cheaper than human labour if it's to find a place in greenhouse production. Robotics are expensive, and being able to build a cheap but effective product is the main goal. Economically priced robotic components are hard to find, says Moussa, especially custom robotics such as those he'll need for the tomato technology.

So why the effort? Greenhouse labour is very intensive. As much as 30 per cent of the cost of production can be attributed to labour. In an industry growing 10 per cent a year, with a combined farm gate value of $600 million in Canada, reducing labour costs is imperative to stay competitive with California or Florida, where similar vegetables are grown and where labour is cheaper. Producers recognize the need; the Ontario Greenhouse Vegetable Growers calls the research an "intriguing" idea that is highly supported by the organization.

Moussa and Abdullah recently unveiled a new research institute, the Robotics Institute@Guelph, which will explore robotics research in non-traditional applications such as agriculture, health care, and residential service. R

■ This research has been funded by the OMAFRA–U of G Partnership and the Ontario Centres of Excellence.

ILLUSTRATION: BRANDON DENARD

A winning case for food packaging and processing

Profs. Massimo Marcone (left), Shai Barbut (centre) and Loong-Tak Lim (right) are using soybean by-products to create bio-based packaging materials and edible films in meat processing.

Soy films could reduce costs for meat processors and make packaging environmentally friendly

BY NATALIE OSBORNE

An innovative idea is wrapping together two of Ontario's largest agricultural sectors: soybeans and meat processing.

At the University of Guelph, researchers are using the by-products of harvested soybeans to develop bio-based packaging materials and edible films to streamline meat processing techniques. Researchers believe their soy plastics could be a greener, more sustainable alternative to petroleum-based plastic.

Using sausages as a model system, the researchers are creating an edible soy-film casing made simultaneously with the sausage, using a process known as co-extrusion.

Prof. Loong-Tak Lim, Department of Food Science, says these films could replace preformed sausage casings, which are usually made from animal intestines.

The co-extruded sausage casing provides many advantages over existing preformed materials by overcoming limitations associated with natural animal casings, such as inconsistent size and thickness, variable material properties, and size limitations. Furthermore, the co-extruded technique is continuous, and allows the casing material to feed automatically without the need to interrupt the sausage-stuffing process to reload the preformed casing.

"We could change the casing formulation more easily and add different ingredients, spices, or even antimicrobial agents to give the product a longer shelf life," says Lim. "By using soy-based casing, we can potentially open up some new possibilities for sausage product development."

Strength is a main concern for soy plastic. Lim and his collaborators are extracting cellulose from soybean husks, pods and leaves and adding them to soy protein to develop stronger and more durable soy films. One method they are investigating is known as electrospinning, which forms nanofibers 500 to 700 times smaller than a human hair.

Lim's group has developed a unique method based on continuous extrusion technology that could be scaled up to an industrial level.

"Most of the packaging material that we use today is based on limited, non-renewable resources such as petroleum. The processing of these plastics can emit carbon dioxide, a greenhouse gas," says Lim. "By using renewable resources, such as soy, we're essentially recycling carbon because, as the soy plant grows, it fixes atmospheric carbon dioxide."

In the future, Lim and his team will examine further applications for soy plastics, such as eco-friendly food wrappers, packaging materials and grocery bags.

- Research collaborators include Profs. Shai Barbut and Massimo Marcone of the Department of Food Science.

- This research is funded by the OMAFRA–U of G Partnership. Additional support is provided by the Hannam Soybean Utilization Fund.

PHOTO: MARTIN SCHWALBE

This research theme seeks to enhance the profitability of agricultural production. It encompasses other areas of the OMAFRA–University of Guelph Partnership research program that may play a significant role in productivity or profitability, including environmental sustainability, consumer demand, bioproduct opportunities, and agricultural and rural policy.

Government support of production systems research is critical for a number of reasons. Animal and plant health and the impact of agriculture on the environment are closely tied to important priorities like safe food and clean water. Legislative requirements, Ontario's changing demographics and market opportunities, and the enormous significance of agricultural production to the Ontario economy all point to the importance of this research theme.

Try a colourful plate for better health

BY CAROL MOORE

Rising health-care costs are a concern in Ontario, and elsewhere. Research has shown that increasing vegetable intake can reduce the risk of cancer, heart disease and diabetes. At the University of Guelph, locally grown solutions are being developed to try to help prevent these diseases, rather than fix them down the road.

One such effort involves understanding the nutrient composition and quality of current and new varieties of tomatoes, potatoes, cabbage, onions and carrots. The new crop varieties being tested have different pigments, such as red, purple and orange, which may indicate additional health benefits.

Prof. Mary Ruth McDonald, Department of Plant Agriculture, and graduate student Chanli Hu are working with Dr. Rong Cao at Agriculture and Agri-Food Canada on this research program.

"Vegetables with different pigments or rich colours have higher antioxidant levels, which are beneficial to human health," says McDonald. "Antioxidants help combat diseases such as heart disease, diabetes and cancer."

McDonald is conducting field trials to see how newly developed crops will fare in Ontario soils. She's testing different pest management strategies, and trying to find the optimum fertilizer levels needed. She's also trying to find varieties with improved nutrient efficiency within the plant.

McDonald believes these colourful vegetables could come at a lower cost to consumers looking for year-round antioxidants. Consumers often turn to imported blueberries and other dark-pigmented fruits to get their antioxidants in the winter. But coloured potatoes and carrots—which are produced in large volumes and can be stored for long periods of time—may provide a cheaper, locally grown alternative.

"Consumers don't need to pay high prices during the winter to eat healthy food," says McDonald. "They can eat Ontario produce, support local farmers and still get the nutritional value."

Prof. Mary Ruth McDonald is testing new varieties of colourful vegetables high in antioxidants.

■ This research is funded by the OMAFRA–U of G Partnership, the Ontario Processing Vegetable Growers and the Fresh Vegetable Growers of Ontario.

PHOTO: ANDRA ZOMMERS

Healthy animals, healthy products, healthy people

BY CAROL MOORE

Dairy researchers are always on the lookout for ways to improve animal health and dairy product quality.

Prof. Brian McBride, post-doctoral fellow Ousama AlZahal and master's student Loren Hopkins from the U of G's Department of Animal and Poultry Science are working with Human Biology and Nutritional Sciences Prof. David Dyck to address a dairy cattle condition called sub-acute ruminal acidosis (SARA) — a sub-clinical disease that affects about one-quarter of all cows in early lactation.

Cows affected by SARA may produce milk with a four-fold increase in trans fat levels, but the milk is otherwise unaffected, and is safe for human consumption.

The dairy products produced from both healthy and affected livestock are being tested on animal models to monitor their effect on glucose uptake and insulin sensitivity.

The researchers are interested in conjugated linoleic acid (CLA) isomers—a family of compounds with the same chemical formula as each other, but different structures—that naturally occur in milk.

CLAs are derivatives of linoleic acid. Research has shown that some isomers are beneficial to human health, for weight management. However, other isomers of CLA may be detrimental.

"On one hand, you have CLA isomers that could be positive for human health," says McBride, "and on the other you have ones that can be negative. During acidosis, the positive and negative isomers almost flip in concentration, the good goes down and the bad goes up."

Prof. Brian McBride (left) and post-doctoral fellow Ousama AlZahal (right) are looking at the connection between healthy animals and healthy products.

The first part of the research was conducted at the Elora dairy research station. The team followed a four-week program, which allowed them to produce butter from healthy cows as well as from cows affected by SARA. The milk was transported from Elora to the Guelph Food Technology Centre and churned into butter.

The butter produced from the healthy cows had low levels of negative CLA, while the butter produced from the acidotic cows had four times the amount of negative CLA and four times the amount of trans fats.

Previous studies conducted by McBride and his research team have led to early detection methods for SARA. This project continues to underline the importance of maintaining animal health.

"We are aiming for early intervention to maintain healthy animals," says McBride. "Healthy animals produce healthy products."

■ This research is funded by the OMAFRA–U of G Partnership, the Dairy Farmers of Ontario and the Dairy Farmers of Canada.

Ontario hazelnut industry has customers lining up

BY KATELYN PEER

Ferrero Inc., makers of Nutella and Ferrero Rocher chocolates, annually imports 12 million pounds of hazelnuts from overseas to its Canadian processing facilities. Prof. Adam Dale, Department of Plant Agriculture, wants to change that—he's planted several international hazelnut varieties here in Ontario to produce high-quality nuts that are resistant to disease.

Ferrero requires a supply of 12,000 to 15,000 acres of trees. The company also has specific requirements for size, shape, taste and quality.

To produce hazelnut trees quickly, Dale is using micropropagation—the practice of rapidly multiplying stock plant material—so that one tree becomes thousands in just weeks. Dale's team is now trying to find a faster way to grow these micropropagated plantlets so they reach maturity quickly and produce hazelnuts.

One problem is eastern filbert blight, a fungus that attacks and kills hazelnut trees and is common in southern Ontario. Over the past 10 years, a pioneering farm in Alymer lost almost all of its 50 acres of hazelnut trees to

PHOTO: MARTIN SCHWALBE

Organic compounds control troublesome bee mites

BY ANDRA ZOMMERS
AND HAYLEY MILLARD

Canada's pollinators are in danger. In hives across North America, honeybee population losses have risen over the last three winters to rates as high as 37 per cent—more than double the rate beekeepers normally experience. It is a critical turning point for honeybees in a struggle for survival against parasitic mites.

"The main factor associated with bee mortality is the spread of Varroa mites," says University of Guelph Prof. Ernesto Guzman, School of Environmental Sciences. These mites are external parasites that suck the blood from honeybees. They're similar to a small tick, and they are visible to the naked eye, being about the size of a pin head.

However, a mite of this size is still extremely damaging to a honeybee.

"If you make a fist, imagine that's the size of a comparative parasite that could suck blood from a human," says Guzman. "This parasite is huge for the size of a honeybee."

Bees that are infested live no more than 50 per cent of their normal lifespan, and are less likely to forage and pollinate. A healthy bee would live about 30 days during the summer, the time of highest activity, and could live about four months during the winter, the time of lowest activity. In both cases, Varroa mites affect the colony. In the summer the infested bee will not reach the foraging age (18–20 days)

and in the winter, the infested bee will not see the spring.

The role of insect pollination in Canadian agriculture is valued at some $1 billion annually, with honeybees accounting for about 75 per cent of that amount. Until issues with honeybee health and population decline are resolved, beekeepers are keeping pace with their losses by importing bees from countries such as Australia. Some have also resorted to splitting their remaining colonies and introducing new queens to the deficient halves to create new hives.

But it's economically unsustainable to continue with this trend, says Guzman.

"It's very costly to split colonies. They don't usually produce honey the next summer because you weaken the population," he says.

He's investigating alternative strategies to combat rising bee mortality rates and has found that certain organic compounds can control mite infestation by as much as 97 per cent. These compounds include thymol (from the herb thyme), oregano oil and clove oil and are relatively non-toxic to bees.

Guzman hopes these compounds could also replace the synthetic pesticides originally suspected to have played a significant role in pollinator decline. Sometimes applied to eliminate mites, pesticides can accumulate to toxic levels over time in the beeswax that makes up the hive.

And although synthetic pesticides have been harmful to bees, Varroa mites have been developing resistance to them. Guzman has found that the organic compounds have effectively controlled the mites without harming the bees.

He and other researchers are also seeing if selective breeding could give bees a genetic resistance to Varroa mites. These methods are currently being tested in a controlled laboratory environment. Guzman says if results continue to look promising, the researchers will begin testing in bee hives.

■ This research is funded by the OMAFRA–U of G Partnership. Additional funding is provided by the Natural Sciences and Engineering Research Council, the Canadian Pollination Initiative and the Ontario Beekeepers' Association.

the disease. Another challenge is Ontario's climate, which is much colder than the hazelnut tree's native growing grounds of the Mediterranean.

However, reasons for optimism abound. Ontario imports about $5-million worth of hazelnuts each year to meet the demands of other companies besides Ferrero. Growing more hazelnuts here would give these other companies a reliable and guaranteed supply, and eliminate import costs that are incurred from international suppliers.

"It's early days, but hazelnuts are one of the few new crops that have large, significant acreage that we can work with," says Dale. "That's why this initiative is so exciting."

■ This research has been funded by the OMAFRA–U of G Partnership, OMAFRA's New Directions program and the Ontario Centres of Excellence.

Boosting Ontario's economy with new crops such as hazelnuts is the pursuit of Prof. Adam Dale.

PHOTOS—TOP: ISTOCK · BOTTOM: DRAGAN GALIC

THE ONTARIO MINISTRY OF AGRICULTURE, FOOD AND RURAL AFFAIRS &

Partners for

Great new ideas

in Ontario's agri-food industry are sparked by the unique partnership between the Ontario Ministry of Agriculture, Food and Rural Affairs and the University of Guelph.

Through the partnership, the university delivers the agri-food research, laboratory services and veterinary clinical training to address Ontario's economic, social and environmental priorities.

It's no surprise that this investment in knowledge and innovation pays big dividends. An independent study* showed that the U of G was able to attract almost two dollars for every dollar of provincial funding. Spin-off benefits from the province's annual investment resulted in a total economic impact of more than $1 billion.

University researchers work collaboratively with their colleagues around the world to advance the province's agri-food industry for the benefit all of Ontarians.

From state-of-the-art laboratory and clinical facilities to pilot plants and research stations, the U of G's specialized expertise and unique facilities help to make Ontario safer, cleaner and more prosperous.

*University of Guelph—OMAFRA Impact Study (Deloitte, 2007)

Safe food, healthy animals and a healthy environment

Prof. Vern Osborne and graduate student Carolyn Borsy

The OMAFRA–U of G Partnership supports the connection between healthy animals and healthy food. Animal Science Profs. John Cant and Vern Osborne are aiming to provide Ontario families with healthier, naturally enriched milk. The researchers are fortifying cows' diets with nutritional, bioactive compounds such as selenium—known for its anti-cancer properties—as well as antioxidants from chocolate powder and green tea extracts. Their hope is that through this process, beneficial bioactive compounds will be passed into cows' milk—and then on to millions of Ontarians.

Creating strong rural communities

Many rural communities in Ontario face one of two scenarios: those near large urban centres may undergo significant transformation and growth, such as the 17 counties and regions in closest proximity to Toronto. Others, however, will struggle to maintain their existing population. Research by Prof. Wayne Caldwell is identifying 'best practices' for planning and economic development that can help communities prosper even where there is a stable or declining population.

PHOTOS—TOP: MARTIN SCHWALBE · BOTTOM: MARCUS MIRANDA

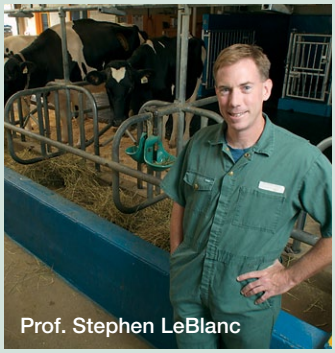
THE UNIVERSITY OF GUELPH

Progress

Valuing our water

Information technology is being applied to assess the economic impact and cost-effectiveness associated with adopting environmentally friendly or best management practices, such as conservation tillage, nutrient management and riparian buffers in agricultural watersheds. Prof. Wanhong Yang, Geography, is using Geographic Information Systems (GIS) technology—a computer modelling system—to combine economic and environmental analyses. Through organizations that develop and implement water-quality improvement programs, GIS technology can be applied to see where it would be best to invest public funds to maximize the environmental benefits and minimize costs to producers.

Prof. Wanhong Yang



Prof. Stephen LeBlanc

Veterinary Clinical Education

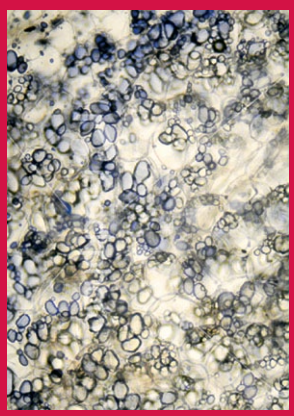
Dairy cow fertility can be a significant factor in the economics of milk production. The partnership's Veterinary Clinical Education Program has supported research by Jocelyn Dubuc, a veterinary science doctoral student in Population Medicine. Working with Prof. Stephen LeBlanc of the Ontario Veterinary College, the project investigated the causes, impact and treatment of reproductive diseases. Dubuc hopes his research will help dairy farmers better understand, diagnose and prevent reproductive diseases, making for more consistently healthy herds and economically efficient farms.

Usable energy from waste material

Unleashing the power stored in manure may be easier than once thought for Ontario farmers. An in-depth look into anaerobic digesters for converting manure into usable energy is being conducted by University of Guelph Campus d'Alfred researchers Anna Crolla and Chris Kinsley to determine the feasibility for farmers to implement and operate a successful system. Their study will measure the financial costs, additional labour and maintenance associated with a digester, compared to potential returns in terms of profitability and energy production.

A thriving agriculture and food sector

The way to a healthy population is through its stomach. For many, that journey starts with starch, an essential carbohydrate that comprises about 75 per cent of the daily calorific food intake. Profs. Michael Emes and Ian Tetlow, Molecular and Cellular Biology, are looking at how to manipulate and modify plant genes and enzymes to produce nutritional, resistant starches that can be incorporated into people's everyday diets through foods such as baked goods. Unlike regular starches, resistant starches aren't broken down in the small intestine, meaning their sugars aren't absorbed as rapidly into the body. As a result, resistant starches act as dietary fibre and may help reduce the risk of Type 2 diabetes and colon cancer.



PHOTOS (CLOCKWISE FROM TOP): MITCH RITTER, ISTOCK, ANNA CROLLA, MARTIN SCHWALBE

The OMAFRA–University of Guelph Partnership supports research in this theme so that government can provide support to Ontario's agri-food industry and rural communities.

Agricultural policy research encompasses many issues related to farming, including agricultural trade and marketing, business and finance, and innovation in economic development. Rural policy research focuses on the challenges and opportunities facing rural Ontario, including current government policies and programs, the impact of climate change, regional development, rural infrastructure, transportation and rural labour markets.

Together, agricultural and rural policy research provides up-to-date, factual information on which to base sound policy decisions.

University of Guelph researchers are working with farmers to help them capitalize on the opportunities of the local food movement.

Closing the gap from farm to fork

How do farmers feel about the local food movement? A U of G study aims to find out.

BY ALYCIA MOORE

Despite economic trends towards increasing globalization, a growing legion of consumers say they're committed to local food and sustainability. The bulk of the discussion is coming from urban dwellers. But how do farmers feel about all this?

Profs. John Devlin and Karen Landman and graduate student Meredith Davis from the University of Guelph Department of Environmental Design and Rural Development have embarked on a research study to better understand how farmers perceive the growing local food movement and their involvement in it.

"Most of the research will take place sitting down with farmers, right at their kitchen tables," says Davis, who was responsible for conducting interviews with 27 farmers from 21 farms in the Waterloo region this past winter and spring.

She questioned the farmers on their motivation to participate in the movement, as well as challenges they have faced. Farmers were also asked for their opinion on what programs or policies should be implemented in the future, to better support the local food movement.

Davis found that Waterloo region farmers are involved in the local food movement in a number of unique and novel ways, including direct on-farm selling, and participating in farmers markets and food box programs. Some participants have started selling seasonal cookbooks, or offering on-farm cooking lessons to reintroduce the lost food skills needed for preparing healthy, fresh, non-processed meals from locally grown food.

"By selling directly, the farmers are more in tune to exactly what the customer wants. Additionally there is a certain level of trust built between the farmer and the customer—the customer may be able to directly observe how the food is being grown," says Davis.

The farmers surveyed came from a number of different agricultural sectors, and also differed with respect to the type of local food initiatives in which they were involved.

Besides the Waterloo area study, researchers will also survey farmers in Prince Edward County and the Sudbury area beginning in the fall of this year. These three distinct agricultural production areas were chosen for their unique geographic characteristics as well as marked differences in the urban-rural divide. These regions also already have a history of being celebrated for their unique initiatives within the local food movement.

The two-year project will finish next spring. Ideally, Devlin would like to expand the project to include all five agricultural census regions in Ontario, to better understand local food activities occurring across the province.

He adds that many farmers participating in the local food movement see it as a promising strategy for preserving the viability of the farm and rural communities. But there are challenges, and a lot of work needs to be done to expand the market and to make it easier for farmers to supply. R

■ This research is being funded by the OMAFRA–U of G Partnership.

PHOTO: ISTOCK

Biomass yields depend on soil carbon

BY ELIZABETH SCHOUTEN

It's not known how much biomass can be removed from the ground without degrading soil structure and productivity. But that information is important as the agri-food sector moves towards using biomass to generate energy. University of Guelph researchers are working on finding the answer.

Profs. Bill Deen and Rene Van Acker, Department of Plant Agriculture, along with Prof. Alfons Weersink, Department of Food, Agricultural and Resource Economics, are honing in on how much biomass is actually available for harvest, versus how much should stay in the soil.

The key is soil carbon, part of soil's organic matter. Maintaining soil carbon is important for long-term soil structure and productivity. It's responsible for binding nutrients in the soil, providing energy for biological processes, as well as maintaining soil structure. Increased levels of soil carbon will help prevent problems, such as erosion from wind or water.

One of the researchers' challenges is finding out how much biomass can be removed without destroying soil fertility.

"We're struggling with the question of how much residue has to be returned to maintain soil carbon over time," says Deen.

Research estimates vary, but Deen believes two-and-a-half tonnes to four tonnes of residue per acre must be returned to maintain existing soil carbon levels. A typical corn-soybean rotation may not generate sufficient residue to enable biomass removal. The various crop rotations used in Ontario differ in residue return, so removal rates may be dictated by rotation.

However, biomass yields can be increased by adding cover crops, or by removing residue less often—every two or three years, for example, instead of every year.

"It may also be necessary to use more complex rotations, such as a corn-soybean-wheat-red clover rotation, to build up biomass," says Deen. That could raise biomass levels by as much as 50 per cent.

Depending on the assumptions of how much residue needs to be returned to the soil, there may not be any biomass available for use in electrical and heat generation.

"The question is, what will we do to the soil productivity and soil quality over time?" says Deen.

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

Researchers are trying to determine how much biomass can be harvested from a field without degrading the soil's structure.

PHOTO: DUPONT

The goal of emergency management research under the OMAFRA–University of Guelph Partnership is to provide a proactive, co-ordinated and comprehensive approach to managing agri-food emergencies in Ontario. Events such as SARS, BSE, swine and avian influenzas and invasive plant pests have shown Canadians the profound impact that outbreaks can have on agriculture, the environment, human health and the economy.

Emergency management research encompasses issues related to zoonoses and public health, foreign animal diseases, plant pests, and food safety. The focus is on disease agents and pests whose sudden emergence or re-emergence in Ontario requires an immediate and comprehensive response.

Portable diagnostic sensor offers immediate pathogen detection

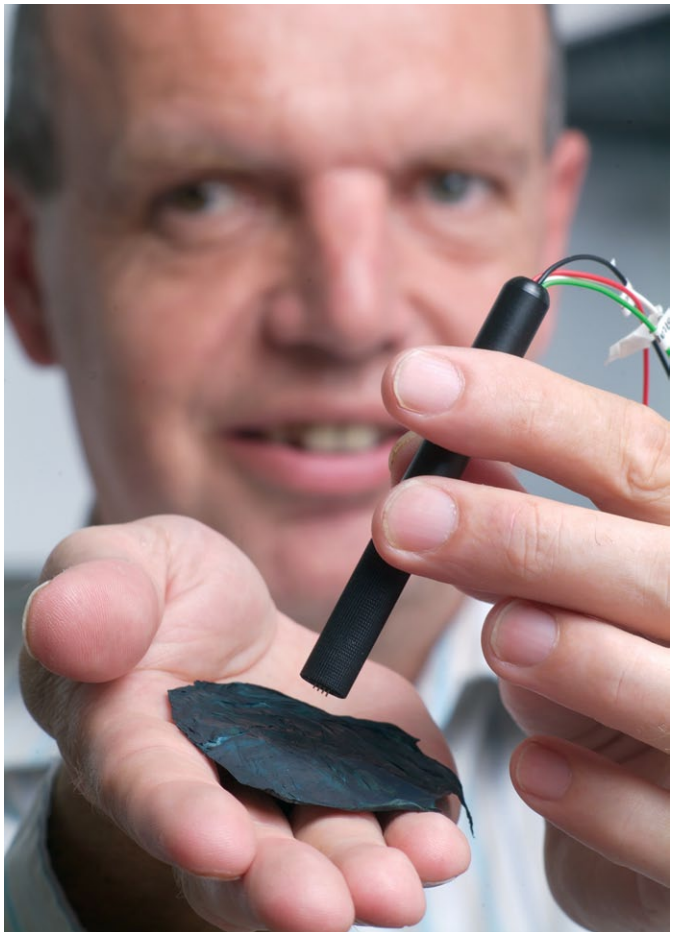
BY JOEY SABLJIC

When it comes to preventing food contamination, speed is of the essence. To prevent an outbreak, researchers cannot afford to wait the several days it may take to get answers from lab tests. Instead, they need to be able to test for contamination and act on it immediately.

With this in mind, Prof. Keith Warriner, Department of Food Science, is collaborating with several food science researchers to develop a sensor device for fast and accurate detection of pathogens and toxins in potentially contaminated food sources.

One challenge is packing all the diagnostic power of a laboratory into a portable, handheld device capable of testing an appropriate sample size.

But the researchers are making progress. They've created a sensor device about 10 cm in diameter, made up of ultra-fine, electro-spun fibres which are formed by passing a polymer solution through an electrical field. Compared to normal woven fibres, electro-spun fibres allow for an extremely large and durable sensor-pad surface area that the researchers can use to extract targets, such as toxins or biohazards, from larger samples. For example, the researchers may take a sample of grain, mix it with water in a container to create a suspension and then submerge the sensor device in the solution to test for toxin or biohazard targets.



Prof. Keith Warriner is developing fast, on-site pathogen-detecting sensors to help prevent food contamination outbreaks.

The sensor is modified with a conducting polymer — an organic metal — which acts as a reporter for interactions between the targets and immobilized antibodies. These polymers are responsive to this interaction, and can be detected by monitoring changes in the electrical conductivity of the pad.

"Emergency management plans aren't very good if you can't detect what you're supposed to be looking for right away," says Warriner. "This way, we can act on the presence of a biohazard and contain it."

Warriner and the research team have produced a working model designed to detect *Salmonella* contamination. They hope to be able to adapt their sensor to test for other contaminants in the near future.

- Warriner's collaborators on the project are Food Science Prof. Loong-Tak Lim, master's students Golam Islam and Tambika Saha, and Prof. Srinard Sreevatasm from the University of Minnesota.
- This research is funded by the OMAFRA–U of G Partnership.

Prof. Deborah Stacey is using SHARCNET, a network of linked supercomputers across universities in southern Ontario, to better understand possible pathways in the spread of animal disease.

Tracking down disease pathways in animals

BY JOEY SABLJIC

Tracking down the different ways disease can enter the food production system is not as clear cut as it may seem—especially when there are many steps along the way from farm gate to dinner plate. Speedy analysis would make a difference not only to animal and human health, but also to the environment and economy.

Prof. Deborah Stacey, chair of the Department of Computing and Information Science at the University of Guelph, is looking for a better way for administrators and researchers to plan for and respond to the spread of animal diseases, based on the numerous paths diseases can take.

And to her, the answer is the Shared Hierarchical Academic Research Computing Network (SHARCNET), a network of high-performance supercomputers linked across universities in southern Ontario.

Stacey and her research team are developing free, open-source software that can be modified to suit individual situations when problems arise. Their new software is designed using a "scale-free" network of "hubs" (instead of a random network) to simulate possible distributions of flocks along the food supply chain.

A hub might be a large chicken operation or meat processing plant that distributes poultry to several supermarket chains. The idea is to illustrate the possible distribution paths poultry could take. In a simulated disease outbreak, epidemiologists can study the differences in disease spread that are caused by various distributions or contact networks.

The software also allows researchers to account for many variable elements, such as farm location, the method of transportation, and whether a related disease is airborne. All of these elements can either trigger or influence the spread of a disease.

Stacey says that being able to model the wide variety of possible paths a disease may take with the help of their new software program will allow government health agencies to study different scenarios and plan for an emergency.

The information will help determine the best course of action—quarantine, vaccination or culling an infected flock—and the possible effect on the plan's effectiveness and economic viability.

"The models can't predict where the infections are going to go, but we can help inform epidemiologists and ministry officials so that they can develop policies if there is an infection," says Stacey.

- The project team also includes research associate Neil Harvey, adjunct professor Greg Klotz and computer science master's students Joel Francis and Saira Ahmad.
- This research is funded by the OMAFRA–U of G Partnership and the Canadian Poultry Industry Council.

PHOTOS: MARTIN SCHWALBE

Strengthening Ontario's pork industry through better surveillance

BY CAROL MOORE

The novel H1N1 human influenza pandemic had a crippling effect on Ontario's swine industry, even though the term "swine flu" was a misnomer. Researchers at the University of Guelph hope to alleviate public concern with a non-invasive way to test pigs for the disease.

Prof. Cate Dewey and research assistant Karen Richardson, Department of Population Medicine, are sampling saliva from finisher pigs across southern Ontario to test for influenza. Their goal is to help bolster consumer confidence and the economic viability of Ontario's pork industry, by proving that Ontario pigs are not a source of the novel H1N1 found in humans.

"This project will serve as valuable information for the pork industry," says Dewey. "They will be able to say with confidence that the novel H1N1 is not a problem in Ontario pigs."

To do that, Dewey and Richardson are collecting saliva samples and testing them with a method to quickly and accurately detect the genetic material of the virus — called a polymerase chain reaction test — at the Animal Health Laboratory at the University of Guelph. The test will determine if the saliva contains any influenza viruses.

Twenty farms from Guelph to Sarnia will be sampled. So far, five pen samples from 16 farms have been tested and all have been found to be free of influenza. However, if any infection is detected, further tests will be performed to see which strain of influenza the pigs are shedding.

"This test is an excellent way to sample a large number of finisher pigs quickly and accurately," says Dewey.

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

An H1N1 pig surveillance system is being developed by Prof. Cate Dewey to help bolster Ontario's pork industry.

PHOTO: MARTIN SCHWALBE

Today's consumers are more interested in food and nutrition than ever before. OMAFRA and the University of Guelph's research into consumer trends, and food production and formulation has the potential to improve the health of Ontarians. It also provides competitive opportunities for producers and agri-food companies.

The OMAFRA–U of G Partnership is committed to supporting research to provide consumers with functional foods—foods that have been shown to have health benefits, such as reducing heart disease and the incidence of diabetes.

The scope of this research theme is large and complex, but the social and economic benefits can be enormous.

Consumers' purchasing decisions, dietary patterns and increased knowledge about the relationship between food and health will drive this research theme forward.

Adding soy to your lunchbox

Researchers are one step closer to commercial-quality, soy-enriched bread

BY REBECCA HANNAM

Bioactive isoflavones, the soybean components connected to improving human health, are the focus of an ongoing study at the University of Guelph designed to incorporate soybeans in healthy food products. This research could provide new opportunities for soybean breeders, growers and processors.

Prof. Alison Duncan, Department of Human Health and Nutritional Sciences, began working with soybean varieties with varying isoflavone content in 2004. Since then, her team has developed a functional food product—bread made from soy flour and soy protein isolate. A more recent study has resulted in an improved formulation of the bread, as well as consumer and industrial acceptance of the product.

"Soybeans have traditionally been researched to investigate agronomic traits, but we're now looking at the isoflavone content of beans from a human health perspective," says Duncan.

The original soy bread, made from isoflavone-manipulated beans grown in Ontario, satisfied many Health Canada nutrient content claims, and was proven to be economical to produce and purchase after research trials and evaluations.

When tested in consumer taste test trials, however, the bread didn't pass muster.

Duncan and her team then investigated its sensory qualities and worked to improve its taste. Evaluations in early 2009 showed the improved soy bread formulation was more accepted by consumers. This part of the project also involved partnering with Canada Bread (Maple Leaf Foods) to test the soy bread for industrial scale production, a trial that proved successful.

"This research shows potential for the consumer-acceptable soy bread to advance into the marketplace," says Duncan.

She hopes to continue studying the impact of soy products on human health before soy bread goes onto grocery store shelves. R

■ This research has been funded by the OMAFRA–U of G Partnership.

Consumers can reap the benefits of great taste and better health with Prof. Alison Duncan's soy-based bread.

PHOTOS: GRAIN FARMERS OF ONTARIO

Fibre-fortified dairy products may help Canadians reach their quota

BY ALYCIA MOORE

Canadians consume only about half the amount of fibre recommended by Canada's Food Guide to Healthy Eating. Researchers at the University of Guelph say it's unlikely that our nation will quickly double its intake of fibre-rich fruits, vegetables or whole grains. But consumers may be more inclined to get their necessary fibre through their favourite dairy products.

Prof. Doug Goff and his team from the Department of Food Science are developing three fibre-fortified products: a milk shake, pudding and ice cream.

"Sensory panels have shown that the concept of healthier dairy products is well received," says Goff. These panels are made up of people trained to describe products based on qualities such as taste, texture and smell.

But, he adds, it's been a challenge to add high levels of fibre to products without drastically changing the products' texture.

"People won't sacrifice quality — it doesn't matter how good the product is for them," he says.

Using fibres with a low viscosity, such as flaxseed gum and soy soluble polysaccharide, has helped the researchers overcome this obstacle. These two fibres are also agriculturally significant in Ontario; they're extracted as by-products from the production of flax and soybean crops.

Goff and his team are simultaneously assessing the nutritional benefits and sensory properties of flaxseed gum and soy soluble polysaccharide. Graduate student Marco Au is conducting human clinical trials to determine blood glucose levels after the test products are ingested. If the products are found to have a low glycemic index they would likely be well received by diabetics.

Meanwhile, Steve Cui and Joshua Gong from Agriculture and Agri-Food Canada are looking at the fermentability of flaxseed gum and soy soluble polysaccharide compared to other fibres. Fermentation refers to the breakdown of dietary fibre, starch and other undigested foods by bacteria in the colon.

"Not all fibre is nutritionally functional, nor is all fibre equal," says Goff.

Fermentation of fibre in the colon produces fatty acids that have added health benefits for regulating metabolic processes.

An additional collaboration with Prof. Harvey Anderson of the University of Toronto is aimed at using fibre-fortified dairy products to control appetite. This project has received funding from the Dairy Farmers of Ontario and Kraft Foods. Goff says this project is particularly important in light of the current obesity epidemic in Canada.

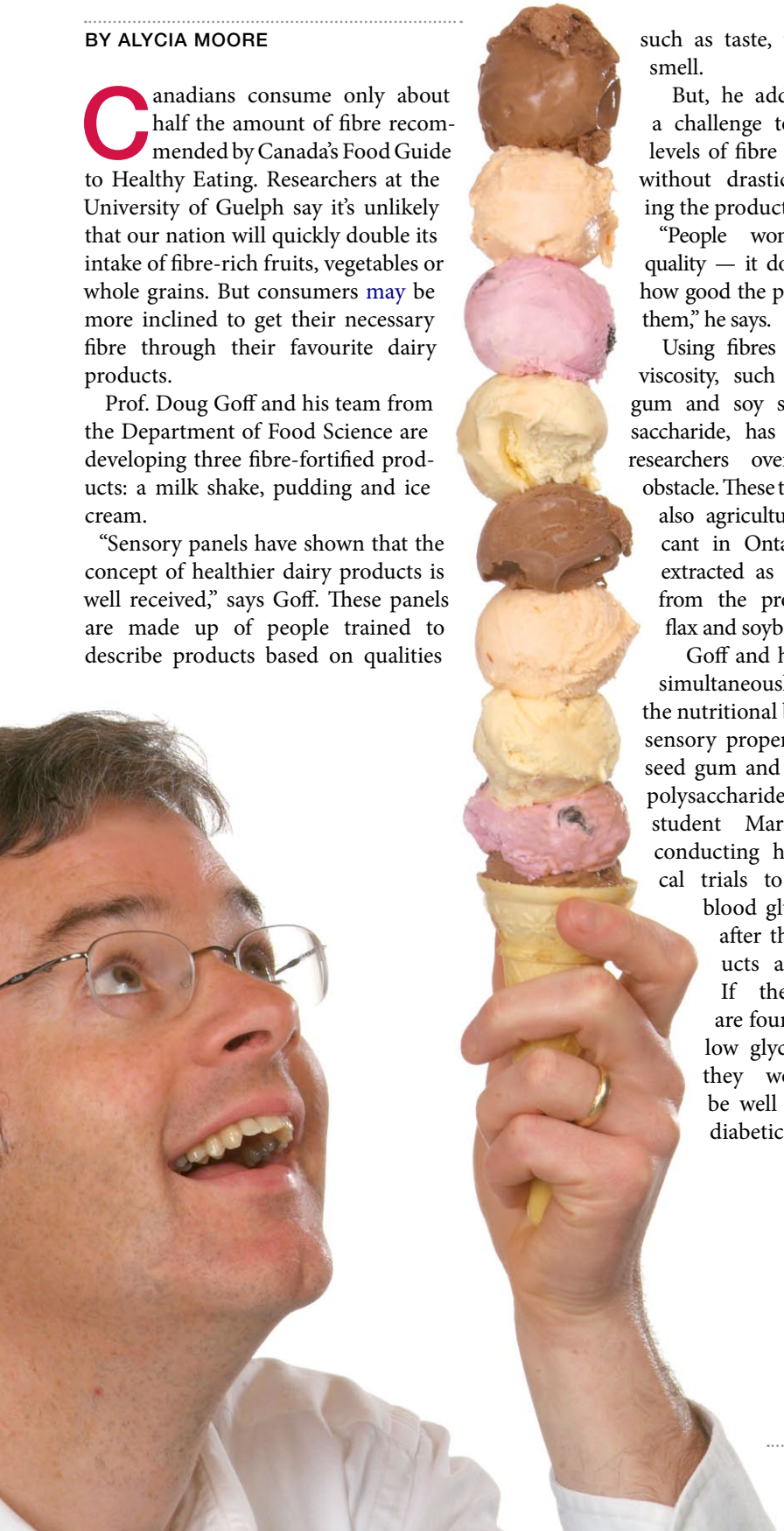
"High-fibre food influences satiety, which reduces total food intake," he says.

Goff hopes it's only a matter of time now before the industry gets more on board with low-fat, no-sugar, high-fibre ice cream products so their benefits can become tangible for consumers.

"People have got the fibre message," says Goff. "We really think there is a clear market opportunity for alternative fibre-containing products."

- Other contributors to this study include graduate student Martin Chen and Prof. Milena Corredig from the Department of Food Science, and Prof. Amanda Wright from the Department of Human Health and Nutritional Sciences.

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



Prof. Doug Goff has found a way to create fibre-fortified sweet treats — helping consumers with a sweet tooth eat healthier.

PHOTO: MARTIN SCHWALBE

Nature's medicine

Researchers look for valuable new uses for Ontario fruit

BY HAYLEY MILLARD

Berries with a colourful, dark hue are enriched with powerful antioxidants called anthocyanins, proven to control human tumour growth and inflammation. University of Guelph Prof. Gopi Paliyath, Plant Agriculture, is researching ways to use Ontario berries to create nutraceuticals with those benefits.

The term nutraceutical—combining the words nutrition and pharmaceutical—describes a food or food product that can provide health and medicinal benefits for disease prevention or treatment.

"Ontario's Niagara area, for example, has plenty of berries with valuable nutrients. We want to expand the uses of the berries for the benefit of Ontarians and the Ontario berry industry," says Paliyath.

He's teamed up with other researchers in the Ontario Agricultural College to develop nutraceutical products that could target human colorectal conditions, such as Inflammatory Bowel Disease (IBD) and Crohn's Disease. Few pharmaceuticals can fully treat these conditions or bring long-term symptom relief.

Humans consume anthocyanins from many different kinds of fruits, but actually absorb very little of the nutrient. This may be due to low absorption, reduced availability through complex nutrient formation, or the breakdown of anthocyanins during digestive processes. Only about one milligram of every gram of anthocyanins consumed is absorbed.

Paliyath thinks the solution could be to develop a nutraceutical product filled with berry anthocyanins in the form of a powder or pill that would release anthocyanins in an easily absorbable form during passage through the gastrointestinal tract.

Before he can arrive at a final product, however, Paliyath is researching various aspects of complex nutrient formation, absorption mechanisms and the anti-inflammatory action of anthocyanins to devise methods for obtaining maximum effectiveness.

One of his previous studies monitored how anthocyanins from merlot grapes influenced tumour growth in a mouse model. The polyphenols in anthocyanins naturally inhibit cell signals, meaning they can prevent the gene expressions that cause the development of potentially cancerous cells. Paliyath found that tumour growth in a mouse model treated with merlot wine polyphenols had slowed considerably, and the tumour growth in a merlot grape polyphenol-treated model had almost completely stopped. The normal cells showed no negative side effects related to the amount of anthocyanin used.

Paliyath is now focusing on Ontario blueberries, strawberries and cherries, and will be using other animal models to see if the same anti-cancer properties still hold up, and if these properties can just as significantly reduce inflammatory responses as well. He will test various anthocyanin concentrations with different types of nutraceutical products, such as supplement pills or powders, to see if they reduce inflammatory responses similar to those that could occur in humans with IBD or Crohn's Disease.

"If these trials are successful, we will then try to determine through human trials what anthocyanin concentrations would be optimal for treating the symptoms of different colorectal conditions, and start formulating ideas for commercial nutraceutical products," says Paliyath.

Research technician Renu Chandra (front), doctoral student Julieta Correa and Prof. Gopi Paliyath (back) offer up locally grown nutraceuticals—Ontario berries—being studied for their anti-inflammatory properties.

- Research collaborators include Profs. Jay Subramanian, Al Sullivan and Helen Fisher of the Department of Plant Agriculture; Milena Corredig of the Department of Food Science; and Ming Fan of the Department of Animal and Poultry Science.
- This research is funded by the OMAFRA–U of G Partnership.

PHOTO: MARTIN SCHWALBE

Increasing the link between dairy consumption and health

BY REBECCA HANNAM

As consumers' demand for healthy food grows, opportunities for new products are on the rise. This is promising news for the dairy industry, as research shows milk products have the potential to become even healthier, says a University of Guelph researcher.

Prof. Milena Corredig, Department of Food Science, is building on this potential with a new study to better understand how the consumption of certain bioactive peptides in milk is related to gastrointestinal health.

Bioactive peptides are small portions of the original proteins in milk that have shown biological functionality. In particular, the peptides studied in this research have been linked to improved immune function. A better understanding of their activity will also contribute to more efficient ways to produce them and to control their delivery.

Once Corredig learns more about peptides, her project will focus on designing ways to encapsulate the bioactive peptides; for example, by designing milk protein nanoparticles. Confining these molecules within a larger encasing structure will help prevent a bitter taste when they are swallowed. It will also protect the peptides from digestion in the stomach, help design optimal doses and ensure delivery to the intestinal tract.

Research at the University of Guelph could make dairy products even healthier, helping with gastrointestinal health and boosting immune function.

"Food scientists continue to bring more evidence that different structures in foods will be digested differently and this will matter for an improved health-enhancing product. I'm figuring out how a milkshake with encapsulated peptides would be digested by our bodies," says Corredig. "The components and ingredient label would be the same as a product made with regular milk but the digestion process could be quite different and could increase health benefits."

Corredig shares her research results with industry product developers through the Ontario Dairy Council, an organization representing Ontario's milk processors, to encourage new product ideas.

- Other research collaborators include Prof. Mansel Griffiths, Department of Food Science and director of the Canadian Research Institute for Food Safety, and Profs. Shayan Sharif and Patricia Turner of the Ontario Veterinary College's Department of Pathobiology.
- This research is funded by the OMAFRA–U of G Partnership and the Ontario Dairy Council.

PHOTO: ISTOCK

Producers gathered at the Elora Research Station in July 2010 to learn about recent research findings from OMAFRA and University of Guelph researchers.

Putting information in stakeholders' hands

BY ALYCIA MOORE

The University of Guelph has a long history of working with the Ontario Ministry of Agriculture, Food and Rural Affairs at the forefront of research and agricultural knowledge extension.

"It's essential to get this research out to where it's most useful," says Bronwynne Wilton, who along with Evelyn Allen, joined the OMAFRA – U of G Partnership management group this year as knowledge mobilization program managers, popularly called "knowledge brokers." In these roles, they manage Agri-Food and Rural Link, a hub for knowledge translation and transfer at the university.

One of their key responsibilities is matching the appropriate researchers with stakeholders who can use research results. That service is just one example of a wide range of knowledge translation and transfer (KTT) activities that accelerate the transfer of knowledge into use.

KTT, an important component of the partnership, also emphasizes the importance of demand-driven research, in what OMAFRA Research and Innovation Branch director Mike Toombs describes as a "push-pull knowledge exchange." Stakeholders' needs determine the research that needs to be done, while researchers disseminate the information using a variety of unique communication channels.

OMAFRA research analyst Duff MacKinnon says stakeholder engagement is essential for effective KTT program formation. "That includes setting research priorities and incorporating user involvement throughout the entire research process," he says.

One of Agri-Food and Rural Link's main programs is funding for projects to explore new KTT initiatives. This program is expected to lead to increased collaboration and communication between researchers, industry and the wider community, as they use KTT principles to reach out to audiences through established knowledge transfer methods as well as in innovative and unexpected ways.

Calls for project proposals are open to all University of Guelph professional staff and faculty members, although collaboration with OMAFRA staff, other universities, industry groups and businesses is encouraged. The first call in summer 2010 was very successful, with 43 proposals submitted. There will also be calls in fall 2010 and winter 2011.

"The Agri-Food and Rural Link program will improve the accessibility of research knowledge outside the traditional academic community," says Wilton.

■ The Knowledge Translation and Transfer program is funded by the OMAFRA–U of G Partnership.

PHOTO: ROB O'FLANAGAN, *GUELPH MERCURY*

Tomorrow's industry leaders

New program develops highly qualified personnel

BY ALYCIA MOORE

Demographic changes in Canadian society continue to create skill shortages in the workforce. At the same time, society is facing pressure from a continually changing economy and increasing global competition. In response, the OMAFRA–University of Guelph Highly Qualified Personnel (HQP) program is helping develop graduate students who are more market-ready and innovative in adapting to the economy's competitive pressures.

The program is part of the OMAFRA–U of G Partnership. A total of $5 million in stipends will be allocated over five years to successful applicants in master's and doctoral programs.

The first call for applicants took place earlier this year and attracted more than 80 candidates, with 24 receiving scholarships. Successful recipients are chosen based on their research's potential contribution to the priorities of the seven partnership research themes:

- Agricultural and Rural Policy
- Bioeconomy—Industrial Uses
- Emergency Management
- Environmental Sustainability
- Food for Health
- Product Development and Enhancement through Value Chains
- Production Systems

Besides fulfilling the normal requirements of their graduate degree program, students participating in the HQP program are required to enroll in a new credit course that integrates science and business in agri-food systems, and complete a job shadow or work term for at least one semester.

"The future of Ontario's economic prosperity rests on making sure we plan for future generations of researchers, public policy makers, and innovators in agri-food," said Stewart Cressman, the chair of the Agricultural Research Institute of Ontario.

Michael Toombs, the director of OMAFRA's Research and Innovation Branch, anticipates that the HQP program's work experience component will be an important networking tool for the University of Guelph, students and industry representatives.

"Participating students have the opportunity to make industry contacts, and are exposed to a wide range of real-world topics in the workplace," says Toombs. "Meanwhile, industry representatives will be given access to very highly qualified individuals."

Top (left to right)—Natalie Litvak, Jerlene Nessia, Amal Roy, Ying Li, Teresa Casey-Trott. Bottom (left to right)—Michael Eregae, Gudmundur Johannesson, Shane Walker (HQP Co-ordinator), Prof. Steve Leeson.

■ The Highly Qualified Personnel program is funded by the OMAFRA–U of G Partnership.

PHOTO: CAROL MOORE

Veterinary Clinical Education Program

The Ontario Veterinary College (OVC) has been a world leader in veterinary health care, teaching and research since 1862. The college works at the intersection of animal, human and ecosystem health, training veterinarians and scientists to improve the health of companion animals, ensure food safety and protect the environment.

The Ontario Ministry of Agriculture, Food and Rural Affairs supports the college's Veterinary Clinical Education Program and the referral veterinary teaching hospital. The hospital is a key component in the training of undergraduate veterinary students, graduate students, interns and residents. It also serves veterinarians and animal owners in Ontario, Canada and the U.S. As part of their training, student veterinarians work closely with clinical faculty who provide a wide array of services to food animals, horses and companion animals.

With the clinical training programs, veterinary students spend their entire final year rotating through the hospital clinical services to gain front-line experience. In addition to this comprehensive program, students are also required to complete an externship, spending eight weeks in a private primary care, mixed species practice.

OVC's post-graduate training programs raise the standard of veterinary health care and related public health in Ontario by graduating highly qualified personnel. OVC graduates contribute knowledge and experience to further the understanding of the complex relationships between humans, animals and the environment.

Taking a holistic approach to public health

BY MATT HAWES

A looming era of mass retirements is expected to dramatically reduce the number of practising public health professionals, creating concerns about the future capacity of Canada's public health system. Veterinary medicine contributes to public health by integrating the study of animal, human and environmental health. The benefits include ensuring a safe, abundant food supply and preventing socially and economically disruptive disease outbreaks.

To that end, the Veterinary Clinical Education Program (VCEP) supports the University of Guelph and the Ontario Veterinary College (OVC) as a leader in the public health field. The program receives funding from OMAFRA to support clinical education for veterinarians in three main areas: clinical capacity (both people and facilities), undergraduate veterinary training and post-graduate veterinary training.

The program also supports Ontario's economy by training professionals skilled in maintaining animal health and welfare, who understand the relationships between animals, people and the environment.

Prof. Jan Sargeant, director of the Centre for Public Health and Zoonoses, believes that the program can help the University of Guelph and the OVC become more influential in the public health field.

Prof. Andrew Papadopoulos, Department of Population Medicine, is co-coordinator of the MPH program.

"The program truly embraces the concept of 'one health,'" says Sargeant. "Human, animal and environmental programs have to work together and be in sync in order to have a healthy planet."

Both the Centre and the Master's of Public Health (MPH) program address current public health issues, such as the debate over raw milk consumption. The organizations work together to develop solutions and train professionals who will meet the future needs of public health in Ontario, Canada and the rest of the world.

Andrew Papadopoulos, the Master's of Public Health program co-coordinator, considers the University of Guelph's program to be a specialized learning experience that differentiates itself from other programs.

"Many master's programs have a strict human health focus, but ours is unique," says Papadopoulos. "Since our program is connected to the veterinary college, it has an animal health as well as a human component which allows students to look at the interface between the two different populations."

VCEP funding supports guest speakers and symposia, as well as a four-year faculty position in ecosystem approaches to health. The funding also helps recruit talent by providing stipends to veterinarians who enroll in the master's program.

Papadopoulos says graduates of the program are well prepared to enter the public health field. They have a breadth of knowledge to help anticipate and prevent the spread of diseases, from both a policy and a science perspective.

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

PHOTO: MARTIN SCHWALBE

Animal Health Laboratory

The Animal Health Laboratory (AHL) unit of the Laboratory Services Division provides a full-service, fully accredited veterinary diagnostic laboratory that supports provincial animal disease diagnosis and surveillance. Scientists and technical staff at the AHL link their expertise with University of Guelph personnel to provide a single source of laboratory services in animal health, encompassing food-producing animals (livestock and poultry), exotic and zoo animals, horses, companion animals and avian and mammalian wildlife populations.

The Ontario Ministry of Agriculture, Food and Rural Affairs and the University of Guelph provide a critical mass of leading veterinary specialists and laboratory staff that contribute to achieving high quality and efficient testing at the AHL.

Services Provided:

- Anatomic Pathology (Guelph and Kemptville)
- Avian Virology
- Bacteriology
- Central Services
- Clinical Pathology
- Histotechnology
- Immunology/Serology
- Mammalian Virology
- Molecular Biology
- Mycoplasmology
- Ontario Hatchery and Supply Flock Policy
- Parasitology
- Surveillance
- Toxicology
- AHL Client Services
- Specimen Reception

Procedures in support of disease surveillance:
2008/09—706,000
2009/10—693,500

Protecting the agri-food sector and consumers from disease

BY KATHARINE TUERKE AND VANESSA PERKINS

Zoonotic diseases can strike fear in the heart of society. The University of Guelph's Animal Health Laboratory (AHL) is an internationally recognized leader in the detection and control of infectious pathogens, helping to protect society from potentially devastating animal illnesses, ensuring human health and a stable economy.

The AHL is now in its third year of a $7.5-million Animal Health Strategic Investment, funded by OMAFRA. This five-year initiative has supported 41 research and development projects focusing on three critical areas: the development of new diagnostic tests, emergency preparedness and baseline disease surveillance.

The AHL helped identify the pandemic H1N1 virus and other related strains using its scanning surveillance system and its ability to transfer data and information on gene sequences among various collaborators across the province and nationally.

"The funding from OMAFRA has put us in a position to maintain AHL's status as a premier testing facility in Ontario and North America," says Grant Maxie, director of the AHL. "We have unique technology that distinguishes us from other Ontario animal health labs and we're keeping it up-to-date for further innovative testing."

Grant Maxie, director of the Animal Health Laboratory

One of the AHL's unique capacities in Ontario is the ability to perform post-mortem examinations on animals to determine causes of death. It also has the special equipment needed to characterize the gene sequences of various viruses and can perform extensive toxicology testing that is unique in Ontario.

The AHL has the expertise of 17 full-time veterinarians with post-graduate training in various specialties, such as pathology and microbiology. With such individuals and specialized equipment, the AHL is making strides in improving the monitoring of disease trends over time, advancing testing technology and playing a key role in early awareness and detection of disease outbreaks.

By October 2010, a new $70-million home for the AHL and the Ontario Veterinary College's Department of Pathobiology will be complete. The new facility has been funded in part by OMAFRA. It will contain updated equipment, and will increase biosecurity and biocontainment, providing more capacity for working with pathogens safely.

"The new facilities and equipment are essential to the sustainability of animal health that is needed in domestic and international markets," says Maxie. "This ultimately benefits Ontario's agricultural economy and human health." R

■ The Animal Health Laboratory is funded in part by the OMAFRA–U of G Partnership.

PHOTO: KYLE RODRIGUEZ

Agriculture and Food Laboratory

The Agriculture and Food Laboratory (AFL) unit of Laboratory Services Division at the University of Guelph has been delivering accurate results for clients in agriculture, food and beverage, corporate and research sectors for over 40 years. With strong alliances in industry, government and academic sectors, this lab provides excellence in food quality and safety testing in Ontario and across Canada.

The AFL provides OMAFRA with high quality, special purpose laboratory services in support of the agriculture and food sectors and rural communities through a critical mass of leading faculty, research personnel and laboratory staff.

Services Provided:

- Analytical Microscopy
- Dairy Analysis
- Drug Confirmation
- Drug Residues
- Food Chemistry
- Immunochemistry
- Microbiology
- Molecular Biology
- Plant Disease Diagnostics
- Soil and Nutrient Laboratory
- Toxicology
- Trace Organics and Pesticides

Tests in support of regulatory programs:
2008/09—402,511
2009/10—403,678

From cow to carton

This program ensures the quality and safety of Ontario's milk

BY KATHARINE TUERKE

Ontario has a rigorous dairy food safety system to ensure that safe, high quality milk and milk products are produced and sold by provincially licensed dairy plants.

The Raw Milk Quality Program is one of the main components of this system. It monitors the safe production, handling and transportation of raw milk prior to it being processed, pasteurized and packaged for consumers.

The program is administered by the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA), with delegated authority to the Dairy Farmers of Ontario (DFO) for the delivery of on-farm inspection. As of June 1, 2010, DFO and the Ontario Dairy Council (ODC) also became responsible for managing compositional testing, as well as the collection and transportation of the raw bulk milk samples to the laboratory. OMAFRA retains the responsibility for food safety testing.

Laboratory testing is an important part of the dairy safety and quality system, and the University of Guelph's Agriculture and Food Laboratory (AFL) is a partner in this program component. The AFL has been providing analytical services to the Ontario dairy industry for over 40 years—starting with composition testing in 1967, and since 1985 by testing representative samples of each farm's raw milk bulk tank routinely for safety and quality.

Recently, changes have been made in the testing system resulting in an increase in the testing frequency for each of the province's 4,250 dairy producers. As of June 1, 2010 every sample of raw milk taken from each bulk tank is now being tested for compositional analysis. This translates into over 800,000 samples tested each year.

DFO provides the individual test results to each dairy farmer. Increasing sample testing frequency will give farmers more information about their product, help them improve herd management and further enhance Ontario's reputation for quality milk.

"Farmers now have additional information to manage their herd's health and nutrition at their fingertips," says Lynne Fruhner, a manager at the AFL. The lab's world-class dairy testing facilities have been chosen, under a contract, to perform the quality testing for DFO and the ODC.

Compositional analysis is performed using infrared spectroscopy, which measures the amount of fat, protein, lactose and other solids present. The water content is determined by checking the freezing point of the milk, which ensures that the milk has not been diluted.

If a sample does not meet the regulatory standards, penalties are applied to the producer. OMAFRA and DFO are notified of unacceptable results and appropriate actions are taken to address the issue and assist farmers with reviewing their on-farm practices.

This program meets the safety and quality requirements of Ontario's government, dairy farmers and processors. Ontario's dairy testing system is a collective effort for the continuous improvement of the Raw Milk Quality Program and sustainability of the dairy industry.

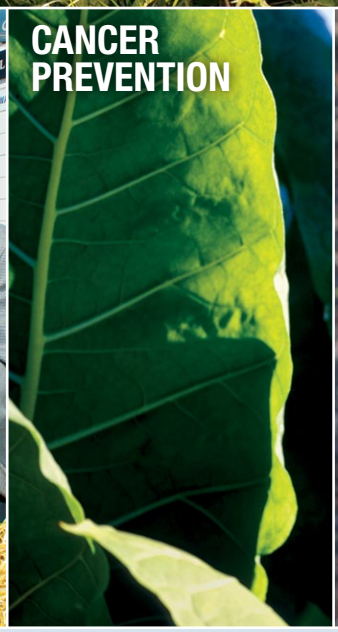
PHOTO: ISTOCK

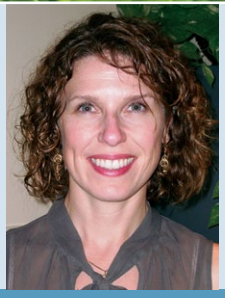
UNIVERSITY of GUELPH

CHANGING LIVES
IMPROVING LIFE

Transforming knowledge that works

The University of Guelph's Business Development Office: Enabling the commercialization of Guelph's world-class research, to change lives and improve life.





Erin Skimson, Director of the Business Development Office, brings a strong background in management, marketing, and technology and business development to the position. Contact her at:

Business Development Office
102-150 Research Lane, Guelph ON N1G 4T2 · Phone 519-824-4120 Ext. 52873 · Fax 519-822-0130
eskimson@uoguelph.ca · uoguelph.ca/research/bdo