research

UNIVERSITY of GUELPH

CHANGING LIVES
IMPROVING LIFE

Volume XXXII
Number 1
March 2015

REACHING NEW FRONTIERS

Guelph technology helps the Mars rover identify water on the red planet.
SEE PAGE 22

INSIDE

50 developments over 50 years of University of Guelph research

It's been an impressive 50 years of research

I had the pleasure of joining the University of Guelph as president last year, midway through the University's fiftieth-anniversary celebrations. The University of Guelph's strong reputation for research and scholarship continues to gain momentum.

As an innovative research institution, and with some 2,000 studies under way here at any given time, we are an economic engine. Contributions from more than 600 researchers across our seven colleges help solve problems and create opportunities in Canada and abroad. In 2013–14, our researchers' efforts were underpinned by $142 million in support from government, business and industry.

Narrowing down just 50 research achievements to include in this publication was a real challenge. We turned to our colleges themselves for guidance. The result gives you a glimpse into the rich past that has made us the vibrant, active University we are today and that will shape our next 50 years.

Thank you for the opportunity to share research highlights from the University of Guelph.

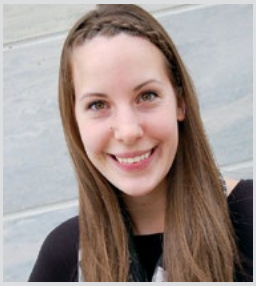
Sincerely,

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

contributors

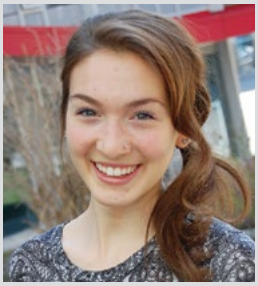
India Annamanthadoo

Hailing from the bustling streets of downtown Toronto, India is a second-year student in the biomedical sciences program. As one of the student co-ordinators of this issue, India was able to delve into many of the research accomplishments from the past 50 years, including technology that's helping cure *C. difficile* infections. **Read about "RePOOPulate" on page 9.**



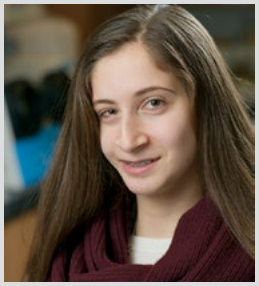
Mallory Kohn

Mallory is a psychology co-op student from Port Perry, Ont. As someone who considers shopping a sport, Mallory was excited to learn how researchers are helping marketers in the tourism industry. She found tourism brands have a major influence on the destinations and attractions people visit. **See what destination came out on top on page 14.**



Alexandra Sawatzky

A fourth-year arts and sciences student from Kitchener, Ont., Alexandra has a passion for exploring issues from various perspectives. So her interest was piqued by research into the role of collaborative management in reducing the impact of chemicals in the ecosystem. **Read all about it on page 10.**



Anna Wassermann

Anna is a third-year bachelor of arts and sciences student from Toronto. She grew up an avid sports fan and dreamed of becoming a sports journalist. Luckily for us, she came to Guelph and realized her passion for science writing. **Anna writes about how researchers are deepening our understanding of cancer in humans and animals on page 41.**

PHOTOS: MARTIN SCHWALBE - SPARK

Rebecca Wilson

Originally from Hamilton, Ont., Rebecca is finishing her degree in finance and economics. As one of the student co-ordinators for this issue, she was pivotal in helping identify some of the biggest stories at the University of Guelph over the past 50 years – including her cover story about how the University of Guelph helped discover water on Mars. **See it on page 23.**

research

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contents

1

Leaf rust disease devastates coffee farms

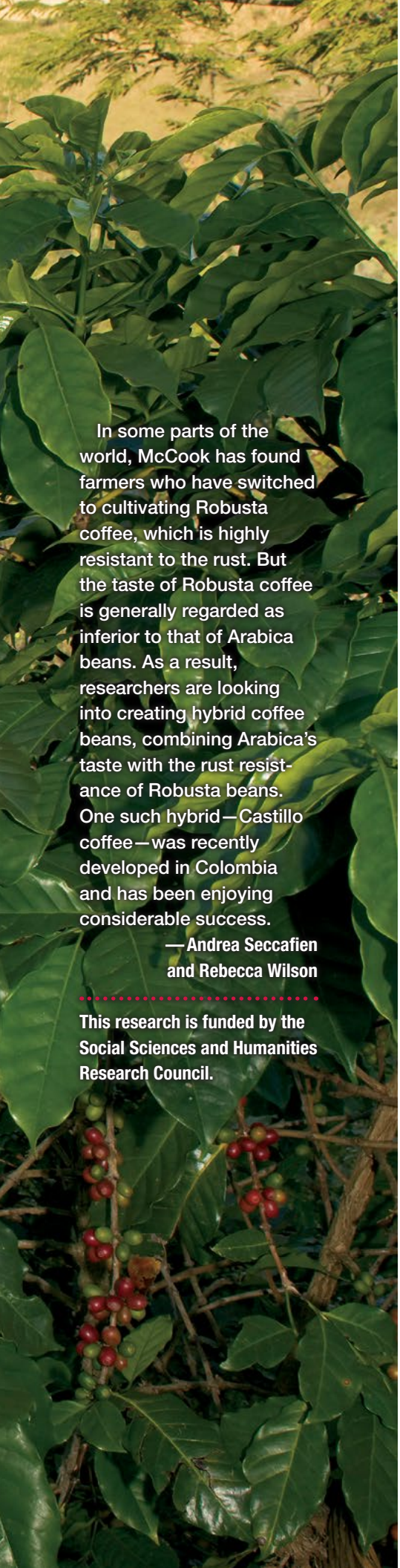
Coffee is one of the most popularly consumed beverages all around the world. The main commercial species of coffee, Arabica, is also highly susceptible to a fungal disease called *Hemileia vastatrix*. This disease—also known as coffee rust—affects coffee trees in almost every coffee-producing nation. It first impairs photosynthesis, then causes defoliation and, in severe outbreaks, a catastrophic fall in yields. Over the past several years, there has been a severe outbreak in Central America, and many farms have lost their entire harvest.

U of G history professor Stuart McCook is working with coffee producers around the world to develop a global ecological and economic perspective on the disease's effects. He is gathering stories of farmers, past and present, struggling with coffee leaf rust around the globe to better understand this epidemic.

Coffee leaf rust first appeared in Ceylon and southern India in 1869. As coffee consumption became more popular in the nineteenth century, global demand for coffee began to vastly exceed the original supply. New countries began producing coffee, creating new fields of vulnerable Arabica plants. The disease gradually spread around the world, following networks of commerce and destroying the high-quality Arabica coffee beans in its path.

To preserve their Arabica coffee, some producers today are choosing to "technify" their farms by investing in modern crop protection products such as chemical fertilizers and fungicides to try to offset the losses caused by the disease. Although these products can be costly, technified coffee plantation can yield up to three times more coffee than traditional coffee farms. Some farmers, especially in Central America, are trying to control the disease with organic strategies.

An Akh hill tribe woman picks Arabica coffee at Doi Chang in northern Thailand.



In some parts of the world, McCook has found farmers who have switched to cultivating Robusta coffee, which is highly resistant to the rust. But the taste of Robusta coffee is generally regarded as inferior to that of Arabica beans. As a result, researchers are looking into creating hybrid coffee beans, combining Arabica's taste with the rust resistance of Robusta beans. One such hybrid—Castillo coffee—was recently developed in Colombia and has been enjoying considerable success.

—Andrea Seccafien and Rebecca Wilson

This research is funded by the Social Sciences and Humanities Research Council.

PHOTO: KEVIN LANDWER-JOHAN / ISTOCK

Prof. Ajay Heble

PHOTO: MARTIN SCHWALBE

Musicians and researchers introduce improvisation into community and classrooms

At the root of successful communities is the willingness of members to actively listen to and collaborate with each other, according to an international team of Guelph-based researchers and musicians.

As part of a collaborative team, University of Guelph English professor Ajay Heble heads up the Improvisation, Community, and Social Practice (ICASP) program. The multidisciplinary, multi-institutional program is an international arts research initiative. It uses musical improvisation as a model for building mutual understanding, co-operation and learning.

These improvised music sessions provide an outlet for people to express their creativity in their own unique ways. With this new-found sense of artistic freedom, they gain confidence in themselves and their abilities, and are empowered to take on more of a leadership role. Heble wonders if the lessons in empowerment learned from musical improvisation can be adopted by other communities to help them develop and advance.

ICASP researchers have created and conducted improvisation workshops at local high schools, at centres for at-risk, aggrieved and disabled children, and at centres for those suffering from post-traumatic stress disorder.

Through these workshops, youth and adults find new ways to express their creativity, gradually working to develop musical skills, songs and compositions.

Members of the research team have put together a resource tool kit that is freely available and that details how other educators can bring improvisation into the community or the classroom successfully.

—Rebecca Wilson

Funding for ICASP is provided through a Major Collaborative Research Initiatives grant from the Social Sciences and Humanities Research Council, along with more than 22 partner institutions and organizations. In 2013, the ICASP project formally became the International Institute for Critical Studies in Improvisation (IICSI). IICSI is supported through the Social Sciences and Humanities Research Council's Partnership Grant program. The initiative was ranked No. 1 among finalists for the prestigious grant.

3

‘Wee country’ has big history

A nod to our strong Scottish roots

With building names such as Macdonald, MacKinnon, McLaughlin and MacLachlan, it should come as no surprise that the University of Guelph has some strong Scottish roots.

In fact, the city of Guelph itself was founded by a Scottish writer and businessman, John Galt, in 1827, and today there remains a large portion of the population with Scottish ancestry.

The Centre for Scottish Studies is unique to not just the University but to the city as a whole, as it allows and encourages Scottish traditions and culture to live on within Canada.

Shortly after the modern University of Guelph was established in 1964, the Centre for Scottish Studies was created. Founding history chair Dr. W. Stanford Reid set about establishing a graduate program focusing on Scottish studies—its history, culture, art and traditions. The program has become North America’s leading centre for the history and literature of Scotland and the Scots.

Although a broad range of research is done—most recently, a study of women in Scotland and an immigration census project—the centre’s main contribution is its engagement with the Scottish Canadian community.

Each fall, the Centre hosts the Scottish Studies Colloquium in Guelph, inviting the best scholars from Scotland, Canada and the world to discuss Scotland’s history and literature. Building on the University library’s Scottish collection—the largest outside the U.K.—and through funding from the Scottish Studies Foundation and other private donors, the Centre established North America’s first endowed chair in Scottish Studies in 2004.

—Rebecca Wilson

Funding of Scottish Studies is provided by the Scottish Studies Foundation along with private donations.

Dusk along Princes Street in central Edinburgh, Scotland.

PHOTO: GEORGE CLERK / ISTOCK

Prof. Daniel Fischlin

PHOTO: MARTIN SCHWALBE

5

Shakespeare in the digital age

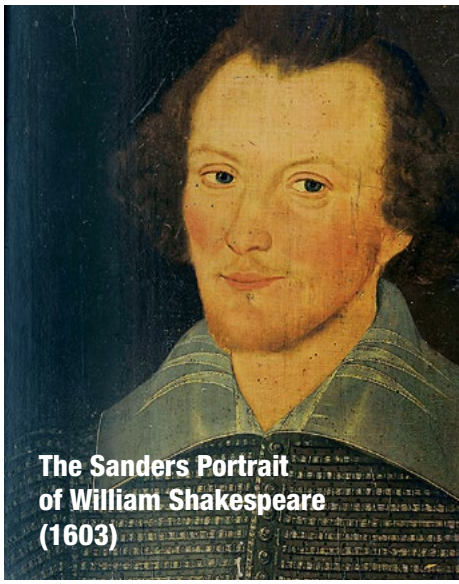
Nearly 700,000 Ontario secondary school students study the works of William Shakespeare each year, but until 2004, Shakespearean resources for students seeking additional teachings were extremely limited. That's changed, thanks to Prof. Daniel Fischlin of the School of English and Theatre Studies.

Fischlin, a modern literary and music scholar in early modern Renaissance, completed the Canadian Adaptations of Shakespeare Project (CASP) in 2004.

CASP is the first research project of its kind devoted to exploring and documenting how Shakespeare has been adapted into a national, multicultural theatrical practice. Visited by up to 60,000 viewers each month (primarily youth), CASP provides users with online access to an assortment of Shakespeare-related articles, videos and activities.

Fischlin also developed a smartphone application known as Romeo + Juliet: The Shakespeare App. This application works as a gateway to related web-based resources, guiding users toward pedagogically useful multimedia content selected by Fischlin. He works to keep Shakespeare alive in the digital age using multimedia approaches, which have been shown to lead to greater student engagement, understanding and interest.

More recently, Oxford University Press has named Fischlin the general series editor for its reissue of the plays from a Canadian perspective (Shakespeare Made in Canada), and the University of Toronto Press has published his work *OuterSpeares: Shakespeare, Intermedia, and the Limits of Adaptation*, featuring work on new digital manifestations of the Bard.


The Sanders Portrait of William Shakespeare (1603)

U OF G, COURTESY OF LLOYD SULLIVAN

—Anna Wassermann

This research is sponsored by the Social Sciences and Humanities Research Council and the University of Guelph Catalyst Centre.

Home to Canada's largest theatre collection

4

More than 150 individual archival and special collections devoted to Canadian theatre currently occupy the shelves of the University of Guelph Library – the largest collection of its kind in the country.

It was named the L.W. Conolly Collection to recognize the contributions of Dr. Leonard Conolly as chair of the University's drama department. Conolly's assistance in facilitating the acquisition of the Shaw Festival archives in 1983 helped set the stage for the extensive growth of Guelph's theatre archives section, featuring the archives of individuals and theatre companies.

With subsequent additions such as the Dan H. Laurence Collection of Shaviana, Shaw materials now occupy more than 110 linear metres of library shelf space.

The collection also features papers from notables such as George Walker, Tomson Highway, Christopher Newton, Sky Gilbert, Cameron Porteous, Cynthia MacLennan, Susan Benson and Judith Thompson, as well as other prominent playwrights, actors, directors, designers and administrators.

—Alexandra Sawatzky

6

Lucy Maud Montgomery Research Centre

Renowned archives bring scholars to Guelph

Lucy Maud Montgomery is one of Canada's most celebrated authors of all time. In her lifetime, Maud—as her close friends and family called her—wrote more than 20 novels and hundreds of short stories and poems. Her most notable work was the novel *Anne of Green Gables*, first published in 1908.

The University of Guelph is home to the Lucy Maud Montgomery Research Centre, which contains one of the largest and most comprehensive collections of Montgomery memorabilia in the world. This collection began in 1981 and includes the famous author's handwritten journals, scrapbooks, handiwork, photo albums, legal and business papers, letters, her beloved china dogs (Gog and Magog) and original typescripts of some of her work. Even the manuscript of *Rilla of Ingleside*, thought to have been lost, can be found in this collection, after being donated in 1997.

Today, the collection is an essential national repository for Montgomery studies. People have come from all over the world, including the United States, Sweden, Scotland, Israel, India, Germany, China and Japan, to see the collection since its acquisition.

Lucy Maud Montgomery

PHOTO: L. M. MONTGOMERY COLLECTION, ARCHIVAL AND SPECIAL COLLECTIONS, UNIVERSITY OF GUELPH

In the fall of 2008, the centre undertook an extensive project to digitize the LMM Collection, allowing fans and scholars everywhere to have more access to Montgomery memorabilia by going online. The centre is sponsored by Egg Farmers of Ontario, Delta Hotels, and the Catherine and Maxwell Meighen Foundation.

The Montgomery journals have been published as *The Selected Journals of L. M. Montgomery, Volumes 1–5*, between 1985 and 2004. *The Complete PEI Journals (Volumes 1–2)* have also been published. A short biography of Montgomery, as well as a bibliography of her works and writings about her, can be found on the website Kindling Spirit.

—Rebecca Wilson

7

Uncovering Ontario's rich rural history

To adequately describe the evolution of Ontario's rich rural history, it's important to understand the integral role of neighbourhoods. Prof. Catharine Wilson, Department of History, is delving into how neighbours worked together to accomplish seasonal tasks and, in the process, developed shared values and collective identities.

Networks of informal labour exchanges drove the organization and functioning of rural neighbourhoods in Ontario. These exchanges served as the basis for economic growth and social support. Wilson says co-operative labour – or reciprocal work "bees" – helped create neighbourhoods that were self-sufficient in labour when individual families were not.

"People often called on their neighbours for help with labour-intensive tasks – such as raising a barn or harvesting crops – and in return would provide a feast or equivalent work," says Wilson. "They worked together industriously, like bees in a hive."

Wilson has collected the diaries of more than 100 Ontario farmers who lived between 1830 and 1960. These diaries contain records of labour exchanges between neighbours and provide real-life perspectives on the internal operations of rural communities.

—Alexandra Sawatzky

Prof. Wilson's research received funding initially from a Social Sciences and Humanities Research Council grant and is now fully supported through the Redelmeier Professorship.

RePOOPulate

Uncovering the mystery of microbial systems

Prof. Emma Allen-Vercoe (front) and her lab give a nod to microbial diversity.

PHOTO: MARTIN SCHWALBE

The human body is occupied by trillions of microorganisms. In fact, by cell count alone, we are 10 times more microbial than we are human. But despite their playing a critical role in our health and well-being, these ensembles of microorganisms—called microbiota—were little-known and little-understood until quite recently.

And it's due in large part to the work of researchers such as microbiology professor Emma Allen-Vercoe that we've finally begun to uncover the mystery of our microbial ecosystems.

Allen-Vercoe's research focuses on normal, healthy gut microflora (intestinal bacteria) and how disruptions in this ecosystem can lead to diseases such as inflammatory bowel disease (IBD), recurrent *C. difficile* infections (CDI) and colorectal cancer.

In particular, her research on the treatment of *C. difficile* using a synthetic stool—dubbed "RePOOPulate"—has caught the attention of many people, following a successful proof of principle trial administered by Dr. Elaine Petrof at Kingston General Hospital.

Here's what happens. CDI causes serious diarrhea in those affected. It is often contracted after a patient undergoes a course of antibiotics that eliminates microbial diversity in the gut, allowing the pathogenic *C. difficile* to flourish. At a 90-per-cent cure rate, fecal transplants are the most effective treatment for CDI. But the possibility of unscreened pathogens in the donor's stool poses a large risk factor.

"RePOOPulate," also known as Microbial Ecosystems Therapeutics (MET), is designed to replace fecal transplants. Instead of using potentially dangerous donor stools, MET uses a multi-species probiotic cultured in Allen-Vercoe's lab. The probiotic is created using stool samples from healthy, antibiotic-free donors and a continuous culture apparatus—designed to mimic the gut environment—that the research team has dubbed "robogut."

In Kingston, the final microbial mixture was administered to two patients with recurrent CDI. Both patients have recovered and remained *C. difficile*-free since.

The success of MET has far-reaching implications for the treatment of CDI worldwide. The creation of a standardized product means that the treatment of CDI can be regulated, which will lead to more use in hospitals and more patients cured.

"*C. difficile* is just the tip of the iceberg of the diseases we can treat with this method," says Allen-Vercoe.

Next, her team plans to address IBD, neonatal infections and animal diseases.

—India Annamanthadoo

Funding for Allen-Vercoe's research is provided by the Canada Foundation for Innovation, Physicians' Services Inc. Foundation, National Institutes of Health, the Ontario Ministry of Agriculture, Food and Rural Affairs, U.S. Department of Defense, the Canadian Cancer Society Research Institute and Crohn's and Colitis Canada. Allen-Vercoe has also co-founded a spinoff company, Nubiyota, to commercialize the MET concept.

9

Working toward responsible waste-water management

"Zebrafish are excellent models for identifying the most potent chemical constituents found in waste-water effluents."
—PROF. GLEN VAN DER KRAAK

Reducing the impact of harmful chemicals released into the ecosystem requires management strategies that are sustainable and environmentally friendly.

That's why Prof. Glen Van Der Kraak, Integrative Biology, is using aspects of his research on reproductive biology in fish to inform better waste management techniques.

He's particularly interested in tracing the constituents found in agricultural runoff and industrial and sewage waste as they make their way through our water treatment systems into the environment. A major focus of his work is on the pharmaceuticals and personal care products that are a growing threat to the environment as our population ages and as our dependence on these products increases.

By examining disruptions to the endocrine systems of fish, scientists can better understand the fate of emerging contaminants in waste-water systems. Working from the Hagen Aqualab on campus, Van Der Kraak uses zebrafish as laboratory models, exposing them to complex effluents or individual compounds and evaluating the effects on their reproductive performance.

"Using these findings, we can make recommendations to industry members and other stakeholders to encourage effective treatments, with sustainability in mind," says Van Der Kraak.

Zebrafish are excellent models for identifying the most potent chemical constituents found in waste-water effluents. These fish also serve as surrogates for effects on wild fish populations as well as a means by which to measure broader environmental impacts quickly and efficiently, says Van Der Kraak.

It's impossible to eliminate all of the chemical constituents found in agricultural runoff and in industrial and sewage waste. So Van Der Kraak aims to evaluate the risks of exposure and, by working with engineers, recommend treatment strategies for various settings and thereby reduce the load of these constituents in the environment.

—Alexandra Sawatzky

This research is funded by the Natural Sciences and Engineering Research Council and the Canadian Water Network.

PHOTOS: SAV / ISTOCK - COURTESY OF GLEN VAN DER KRAAK

DNA Barcoding

Two million down, 98 million to go

Earth may be home to as many as 100 million multicellular species, but scientists have been able to formally describe only 1.7 million of them over the past 250 years. The study of biological diversity has been hindered by the limited ability of humans to recognize many organisms.

But that's changing with DNA barcoding, created by University of Guelph professor Paul Hebert.

DNA barcoding is a species identification system that uses DNA from a standardized region of the genome to identify plants and animals in all stages of life.

Think of how a supermarket scanner distinguishes products using the black stripes of the Universal Product Code. In the same way, DNA barcoding can identify the species from a short DNA sequence isolated from a snippet of tissue.

Laboratory technicians use each small piece of tissue as a source of DNA. The barcode region is then replicated and sequenced. The sequence is given a series of letters representing nucleic acids. Once the barcode sequence is obtained, it is placed in the Barcode of Life Data Systems (BOLD)—a reference library of DNA barcodes used to identify unknown specimens.

Hebert's discovery sparked the International Barcode of Life project, the largest-ever initiative in biodiversity genomics, involving more than 1,000 researchers in 26 countries around the world. The project, which has its secretariat at the University of Guelph, is creating a unique barcode library to classify all species according to their DNA.

Since the project's inception in 2003, it has helped scientists collect and classify species—and now stores more than 3.5 million barcode records. DNA barcoding has led to the discovery of hundreds of overlooked species of birds, bats, butterflies, fishes and marine algae.

The technology is also being used to recognize cases of food contaminants, to identify mislabelled food and other products, and to improve pest and disease control and regulation of international trade and markets. Through DNA barcoding, researchers are able to determine exactly what ingredients are in a bottle and whether they match those listed on the label.

This research takes place at the Centre for Biodiversity Genomics within the Biodiversity Institute of Ontario, at the University of Guelph.

—Rebecca Wilson

This research has received more than $75 million from the Canada Foundation for Innovation, Genome Canada, the International Development Research Centre, the Ontario Ministry of Research and Innovation, and the Natural Sciences and Engineering Research Council.

DNA barcode sequence

PHOTOS: BIODIVERSITY INSTITUTE OF ONTARIO · SHUTTERSTOCK

11

The Advanced Analysis Centre

Innovative research in the physical and life sciences

The University of Guelph's high calibre of novel research in the physical and life sciences is supported by an impressive collection of modern research facilities, such as those found in the Advanced Analysis Centre (AAC).

The AAC contains a wide array of state-of-the-art laboratories that house more than $40-million worth of scientific instrumentation. The centre enables research and advanced education at the interface of physical and biological sciences for faculty, staff and students at the University, as well as for other academic, government and private-sector institutions.

The six main research laboratories are the Genomics Facility; the Mass Spectrometry Facility; the Phytotron; the Molecular and Cellular Imaging Facility; the Nuclear Magnetic Resonance Centre; and the X-ray Diffraction and Scattering Facility.

Within each of these facilities, staff supports a wide range of research.

- The Genomics Facility offers services in Sanger sequencing, "Next Generation" sequencing, microarray and qPCR.
- The Mass Spectrometry Facility allows researchers access to cutting-edge equipment capable of identifying and quantifying small metabolites and large biomolecules.
- The Phytotron, located on the top floor of the Summerlee Science Complex, provides unique institutional capabilities for growing plants under a variety of controlled environmental conditions.
- The Molecular and Cellular Imaging Facility offers high-resolution imaging of biological and non-biological samples. The facility hosts advanced light and confocal microscopy systems, as well as transmission electron microscopes equipped for cryogenic and sub-nanometre resolution imaging.
- The Nuclear Magnetic Resonance (NMR) Centre is equipped with a series of NMR spectrometers for solution and solid phase analysis of molecules. The centre addresses many questions about structure-function relationships in small molecules, polymers, biological membranes and proteins.
- The X-ray Diffraction and Scattering Facility uses a variety of X-ray techniques to characterize the structure of advanced materials, such as bioproducts and nanoparticles.

— India Annamanthadoo and Rebecca Wilson

For more information on the Advanced Analysis Centre, visit uoguelph.ca/aac.

12

The Human Nutraceutical Research Unit

Where nutrition and pharmaceuticals meet

A "Better Bagel"

The study of nutraceuticals – compounds at the intersection of nutrition and pharmaceuticals – is becoming a more important topic as waistlines and chronic health conditions both increase.

To foster collaboration in this budding field, University of Guelph researchers teamed up in 1998 to create the Human Nutraceutical Research Unit (HNRU).

The HNRU is a research and educational unit within the Department of Human Health and Nutritional Sciences at the University of Guelph.

HNRU researchers study novel, value-added foods that promote health, enhance performance, and prevent and manage numerous diseases.

One such project conducted at the HNRU was the "Better Bagel" study. Researchers teamed up with Canada Bread and Maple Leaf Foods to develop bagels that are high in resistant starch, a type of dietary starch that is thought to slow the rate of sugar absorption from food. This could be a critical factor in lowering the risk of Type 2 diabetes.

If the clinical trial proves effective, "Better Bagels" could become part of a dietary strategy for diabetes prevention and management.

— India Annamanthadoo

Finding novel ways to solve antibiotic resistance

A report from the World Health Organization last spring alerted the public that the era of killer antibiotic-resistant bacteria is upon us. The number of these bacteria has been increasing significantly, and researchers are searching for novel ways to prevent these microbial infections.

Microbiology professors Chris Whitfield and Joseph Lam are both Tier 1 Canada Research Chairs whose teams study pathogenic bacterial cell surfaces and the role these structures play in infections.

Specifically, the cell envelope of a bacterium is shielded by complex sugars known as polysaccharides. They protect the bacteria from the host's defences, promote colonization and participate in cell-to-cell recognition.

"Bacteria cover themselves with sugars," says Whitfield. "The game is to change the composition of these sugars to look different in order to avoid recognition." Meanwhile, says Lam, "the goal of other bacteria is to assimilate sugars from host tissues to mimic the host to avoid detection."

The success of the bacterium depends largely on its surface coat, so destroying the structure would render the bacteria ineffective and prevent infection. Whitfield and Lam are researching how to do this by studying the biosynthetic pathways of the sugar coats in various pathogenic bacteria that cause distinct infections.

Their goal is to identify an appropriate target in the pathway, such as an enzyme, that could be used to develop a new type of antimicrobial.

Antimicrobials based on cell-surface destruction would be able to destroy otherwise antibiotic-resistant bacteria. These antimicrobials would also have a narrower target range of bacteria than traditional antibiotics, which tend to wipe out even normal, healthy microflora. That leads to further infection by opportunistic pathogens such as *C. difficile*, which normally would not infect a healthy individual.

The researchers are now participating in a recently funded National Centres of Excellence program called Glyconet that promotes collaboration among Canadian leaders in the glycosciences.

—India Annamanthadoo

Funding for research by Whitfield and Lam is provided by the Natural Sciences and Engineering Research Council, the Canadian Institutes of Health Research, Cystic Fibrosis Canada and the Canada Research Chairs program.

PHOTO: SHUTTERSTOCK

When it comes to tourism brands, nothing beats Canada

Tourism brands have a major influence on the destinations and attractions tourists visit and the suppliers they use, from airlines to hotels. Like product brands, places also have meaning, personality and attitude. And because people so often identify with and relate to brands—even to define themselves—those brands have influence.

University of Guelph professor Statia Elliot, director of the School of Hospitality, Food and Tourism Management, teamed up with market research firm Ipsos in September 2014 to survey 2,000 Canadians and 2,000 Americans and find out which tourism brands are on top.

The online survey assessed the influence of 100 tourism brands, including destinations, attractions, online travel agents, airlines and hotels, as well as the dimensions that drive each brand's influence.

Canada, as a travel destination brand, came out on top.

"This study is the first-ever ranking of the most influential tourism brands, and of what drives that influence, to help tourism and destination marketers," says Elliot. "People are travelling more and more, and subsequently there is a growing interest in understanding traveller choices."

Nine dimensions of influence were identified, says Elliot, with each brand having its own mix of influences.

What Elliot calls "guiding light" brands (Air Canada) are seen as helpful and understanding. "Virtual dream" brands (Italy) are researched but not necessarily visited. "Comfort zone" brands (Canada) are considered friendly and down-to-earth.

There are also "connected" brands (Airbnb); "big shot," established brands (Disney); "omnipresent" advertiser brands (Trivago); "corporate citizen" brands (Banff); "bold," edgy and original brands (Las Vegas); and "prestigious," high-end brands (Four Seasons).

Elliot will use the findings to help hospitality and tourism marketers improve their branding.

—Mallory Kohn

Collaborating on this project is Luc Durand, president of Ipsos Quebec. Funding was provided by Elliot's research fellowship awarded by the College of Business and Economics.

Most influential tourism brands

Rankings by Canadians

1. Canada
2. British Columbia
3. USA
4. Ontario
5. Air Canada
6. WestJet
7. Disney
8. Banff National Park
9. Tripadvisor
10. Expedia

Rankings by Americans

1. USA
2. California
3. Florida
4. Disney
5. Southwest
6. Las Vegas
7. Marriott
8. Expedia
9. Delta Airlines
10. Tripadvisor

PHOTO: MUSKOKA STOCK PHOTOS / SHUTTERSTOCK

Identity conflict affects competitiveness in female professionals

Despite making huge leaps in society, women—even professionally oriented women—still shy away from competitive situations compared to men, research shows.

Participants were primed with questions meant to elicit a specific identity.

Prof. Bram Cadsby, Department of Economics and Finance, discovered that women's decisions to avoid competitive situations may be due to a conflict between their professional and gender/family identities.

Male and female MBA students at the Rotman School of Management were asked if they wanted to earn money based only on their own performance or compete with three other students for a larger prize.

This research involved a tool called priming. Participants were primed with questions meant to elicit a specific identity—gender/family, professional or neutral.

Among women, professional priming resulted in a greater preference for competition, but gender/family priming did not. However, this was only evident in female participants. This suggests that a woman's professional or gender/family identity's dominance affects her willingness to participate in competitive situations.

—Mallory Kohn

PHOTO: WOLFFGANG PHOTO / ISTOCK

Collaborating on this project were Fei Song of the Ted Rogers School of Management at Ryerson University and Maroš Servátka of the University of Canterbury. Funding for this project was provided by the Social Sciences and Humanities Research Council.

Moving up by moving on

University graduates today are becoming more and more restless as they pursue impossibly high career expectations, says a U of G professor.

Management professor Sean Lyons has spent several years researching intergenerational differences and their impacts on workplace dynamics. He has found that millennials—those born in the 1980s and into the 1990s—are more driven and demand faster career advancement than previous generations.

Yet millennials are less likely than previous generations to stay in a job long-term.

In a three-year study, Lyons and his research team found that, in comparison to the baby boomer generation, millennials change careers three times as often.

"These young people are constantly looking for a better job—they are moving up by moving on," says Lyons.

Millennials also have unrealistic expectations when it comes to salaries. A 2010 survey of university students revealed that their early salary expectations were realistic, but their expectations after five years in the workforce were unreasonably high.

Job markets are becoming increasingly competitive. Obtaining an undergraduate degree is no longer adequate for securing a job. Lyons believes that young employees need to adjust their expectations while employers try to accommodate this new wave of workers.

—India Annamanthadoo

Collaborators include Linda Schweitzer (Carleton University) and Ed Ng (Dalhousie University). Funding for this research is provided by the Social Sciences and Humanities Research Council.

17

Food Price Index

Forecasting food price changes

Volatile economies make consumers nervous. And with food prices being one of the biggest concerns for most consumers, researchers are always looking for better ways to predict what food will cost in the coming year.

PHOTO: VALESTOCK / SHUTTERSTOCK

Since 2010, University of Guelph researchers in the College of Business and Economics have published a Food Price Index (FPI), a tool that focuses on factors expected to shape prices for Canadian consumers over the next 12 months. The report is now published by the Food Institute at the University of Guelph.

Included in the index are macroeconomic factors, such as energy cost and climate; sector factors, such as food processing industries and consumer food awareness; and domestic factors, such as consumer debt, income and income distribution.

Assuming the current laws and regulations remain unchanged during the projection period, the FPI should provide the basis for examination and discussion of Canadian retail food prices.

Profs. Sylvain Charlebois and Francis Tapon, who created the index, hope that more awareness of rising prices will help reduce overall food waste, now standing at about 40 per cent of all food purchased by Canadian households.

—Rebecca Wilson

Others involved include Profs. Mike von Massow and Erna Duren.

"Light" but not right

18

For cigarettes and other tobacco products, marketing is everything. The U.S. tobacco industry spent $8.4 billion domestically on cigarette advertising and promotion during 2011. An effective marketing strategy is crucial to hooking and holding onto users in an era when consumers are generally well-educated about the dangers of smoking.

University of Guelph marketing professor Tim Dewhirst has served as a consultant in tobacco litigation in Canada and internationally.

Dewhirst analyzes the marketing agendas of large tobacco firms by reviewing internal corporate documents made public through litigation.

To date, his most influential work focuses on low-yield or "light" cigarettes and the deceptiveness of marketing surrounding these products. Tobacco companies claim "light" cigarettes contain lower amounts of tar—a sticky brown substance that is the main cause of lung and throat cancer in smokers—than their parent brands.

This approach plays well with the consumer market for tobacco, which is unusual. Dewhirst estimates that 80 to 90 per cent of users express regret about smoking and many desire to quit. Low-yield cigarettes offer users reassurance about smoking and provide a supposedly "healthier" alternative to regular cigarettes.

Of course, these cigarettes don't offer health benefits. Dewhirst found that smokers tend to compensate for the low tar yield by inhaling more deeply, by smoking more of an individual cigarette or by buying more cigarettes.

Dewhirst also looks at advertising and brand strategy, and explores why some brands prosper while others fail.

"Tobacco has been Canada's No. 1 public health problem, and it is the largest cause of preventable illness and premature death," says Dewhirst. "My research tries to inform policy to reduce tobacco use."

—India Annamanthadoo

Funding for Dewhirst's research has been provided by the Canadian Institutes of Health Research.

Bringing zoned-out gamblers back to reality

In Ontario, nearly 15 per cent of people who say they enjoy gambling—a full six per cent of the general population—are problem gamblers. That means they gamble despite negative, even harmful, consequences.

Many are drawn to the bright lights and ringing bells of casinos. And that's what the University of Guelph's Karen Gough believes is part of their problem. Gough, a professor of marketing and consumer studies, is an expert in the psychological impact of gambling environments.

In some of her earliest studies, Gough observed the so-called cognitive overload of a casino—the lights and noise—makes many slot machine players enter a dissociative state. They get mesmerized by repetitively pressing buttons and pulling levers. Then they lose track of time, not to mention money.

To counter this phenomenon, Gough explored what are called restorative elements—relaxing images, such as a tropical beach or galloping horses—to try to reduce the intent to gamble. In her lab, she developed a 3D simulated gambling system that showed how gamblers are less likely to enter a dissociative state in comfortable venues with restorative elements that draw attention away from the bright lights and loud noises.

Gough's research has prompted casinos to acknowledge the importance of understanding problem gambling and to co-operate with researchers on further studies.

— Anna Wassermann

This research is sponsored by the Ontario Problem Gambling Research Centre.

PHOTO: LARA BELOVA / ISTOCK

Pictured here are Prof. Kris Inwood (right), Andrew Ross and Luiza Antonie.

Piecing together intergenerational trends

A novel approach to studying Canada's socio-economic history

Incorporating a careful reading of historical context into our understanding of socio-economic change can help us to understand and respond better to the challenges we face as a society today.

Prof. Kris Inwood, College of Management and Economics and College of Arts, pieces together the right combinations of theory, method and evidence to foster a better understanding of the past and long-term change in the social, economic and physical well-being of the population.

For example, Inwood has found that patterns of long-run changes in height are consistent with age-specific mortality and with the relationship between income and physical well-being in Canada. His research also shows that, within Canada, dramatic improvements in health may have begun first in southern Ontario at the end of the 19th century because of a decentralized urban framework and relatively modest social inequalities.

So how does he do it? Gathering sufficient evidence for large numbers of people and tracking changes in past populations pose many methodological challenges, including the systematic generation of connections among various sources.

"We have access to databases that list essentially everybody in Canada, the U.S. and Britain. By drawing linkages between them, we can recreate life histories that follow individuals over their lifespan," he says.

Inwood has helped establish the Historical Data Research Unit (HDRU) as a means of harnessing the skills of a multidisciplinary team. Major collaborators are post-doctoral researcher Andrew Ross, Department of History; research associate Luiza Antonie, School of Computer Science; Prof. John Cranfield, Department of Food, Agricultural and Resource Economics; and professor emeritus Richard Reid, Department of History.

Through the use of novel data and software infrastructure, the HDRU can access information on intergenerational trends of entire populations throughout history. So Inwood is able to study the long-term evolution of labour mobility, socio-economic status and health to permit comparison across gender, environments and social classes.

—Rebecca Wilson and Alexandra Sawatzky

Funding for this research is provided by the Social Sciences and Humanities Research Council, the Canada Foundation for Innovation and the Ontario Research Foundation.

PHOTO: MARTIN SCHWALBE

21

A down-to-earth approach to nanotechnology

Ontario cornfields have long been a source of food, feed and, more lately, fuel. But thanks to tiny particles discovered in a University of Guelph lab, cornfields are poised to become a source of new eco-friendly products.

Physics professor John Dutcher is immersed in finding how so-called nanoparticles derived from corn can serve as non-toxic, biodegradable replacements for engineered nanoparticles or petroleum ingredients.

The nanoparticles discovered in Dutcher's lab—half a billion could fit onto the end of a pin—are made from natural sugars. They have many special properties, including extraordinary water retention, very low viscosity in water, and the ability to protect and deliver bioactive compounds. These properties make the nanoparticles very attractive for applications in foods and beverages, cosmetics and even biomedical treatments.

The nanoparticles, known as PHYTOSPHERIX, are being commercialized through the start-up company Mirexus Biotechnologies (www.mirexus.com).

Another researcher employing nanotechnology techniques in plant and food science is Prof. Jay Subramanian of the Department of Plant Agriculture. He and a team including Profs. Alan Sullivan, Gopi Paliyath and Loong-Tak Lim are using nanotechnology to improve on-farm storage of tender fruit—including peaches and berries—which tends to spoil quickly after being picked.

The key to preserving tender fruit is better on-farm storage, involving a natural preserving agent called hexanal. Hexanal is used by manufacturers to produce fruity flavours, but recently it's been shown to have preservative powers as well. However, preservation techniques have been relatively ineffective, because hexanal tends to evaporate quickly or get washed away with the rain.

To improve tender fruit storage, Subramanian is working with nanoparticles to see if they can retain hexanal and release it over an extended period.

Prof. John Dutcher

PHOTO: MARTIN SCHWALBE

—Anna Wassermann

Dutcher's research is sponsored by the OMAFRA – U of G Partnership. Subramanian's research is supported by the International Development Research Centre with financial support from the Government of Canada, provided through Foreign Affairs, Trade and Development Canada, and the Ontario Ministry of Agriculture, Food and Rural Affairs.

22

Southern Ontario Water Consortium

Waste water has changed, and so must treatment

Processes and technologies in waste-water treatment facilities have remained practically the same for the last 50 years, says engineering professor Ed McBean. This means waste-water plants may not be filtering out emerging contaminants, such as new pharmaceutical compounds.

McBean, Canada Research Chair in Water Supply Security, has helped develop and direct the Guelph Wastewater Facility as a part of the Southern Ontario Water Consortium (SOWC). The consortium is a collaboration among the University of Guelph and seven other Ontario universities that allows private companies and researchers to test and develop waste-water treatment technologies.

Each university has its own research focus with accompanying research facilities for the use of developers.

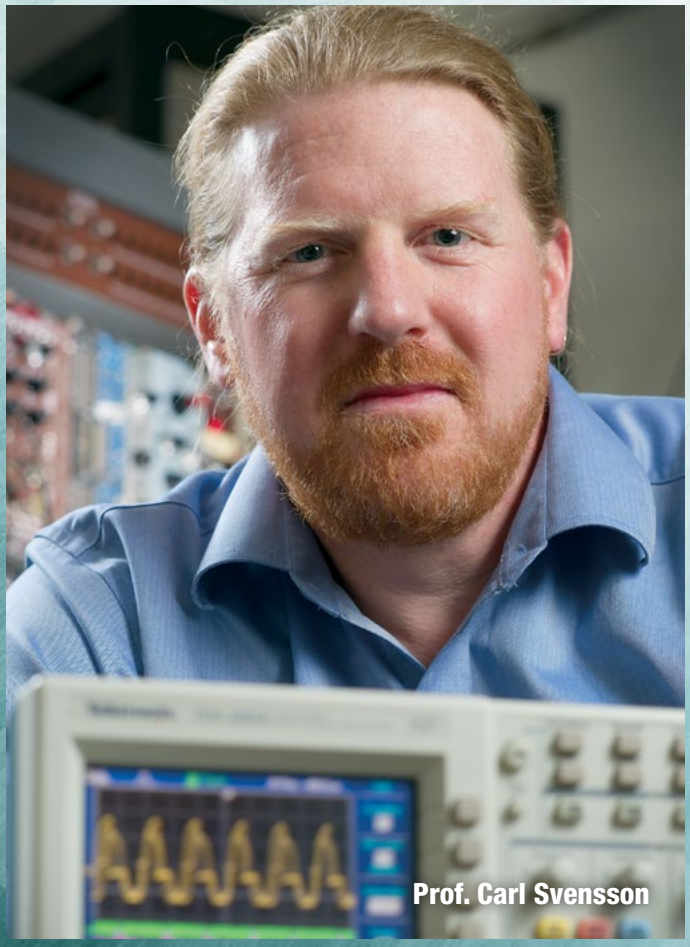
The Guelph research facilities include the Guelph Wastewater Facility as well as a collection of highly advanced analytical labs around campus. Five firms are currently using the city facility to study technologies that improve efficiency of sewage treatment. McBean says that the research facilities will help foster industry partnerships by providing the industry with resources that may otherwise remain inaccessible.

Besides his involvement in SOWC, McBean has been a leading expert worldwide on water infrastructure and low-tech water treatment technologies. He's led courses for international engineers, helped to develop water filtration systems, and served as a consultant for clients around the globe.

—India Annamanthadoo

23

Understanding matter



Prof. Carl Svensson

PHOTO: MARTIN SCHWALBE

The basic elements that are heavier than hydrogen and helium are formed in stars and other astrophysical environments—but how? University of Guelph researchers are deepening our understanding of how the chemical elements that make up human beings are created in the cosmos.

Physics professor Carl Svensson and his team are using gamma-ray spectroscopy of rare isotopes to understand the fundamental properties and origins of matter in the universe. Known internationally in the field of subatomic physics, Svensson has helped develop tools needed to probe the inner workings of atoms.

Between 2003 and 2009, Svensson led a team of 70 scientists building an advanced gamma-ray spectrometer called TIGRESS, an acronym for TRIUMF-ISAC Gamma Ray Escape Suppressed Spectrometer. It's housed at TRIUMF, a subatomic physics laboratory in Vancouver.

Over the past three years, Svensson also led a Canadian team building a second major gamma-ray detector known as GRIFFIN (Gamma Ray Infrastructure for Fundamental Investigations of Nuclei). This giant microscope, also housed at TRIUMF, uses gamma rays instead of visible light to allow scientists to study matter at an atomic level.

—Anna Wassermann

This research is sponsored by the Natural Sciences and Engineering Research Council, the Canada Foundation for Innovation and the Ontario Ministry of Research and Innovation.

24

SHARCNET

Quickly and accurately identifying the spread of disease

The Shared Hierarchical Academic Research Computing Network (SHARCNET) is a multi-institutional, interdisciplinary, high-performance computing consortium dedicated to the research and development of computational techniques and high-performance computers (HPC).

At the University of Guelph, researchers in the network are working to generate advancements in science, engineering and business.

For example, Prof. Deborah Stacey, College of Physical and Engineering Science, is using SHARCNET's HPCs to create and analyze a model that simulates the spread of disease in animals.

In particular, she's investigating foot-and-mouth disease, an infectious and sometimes fatal viral disease that affects cloven-hoofed animals.

Stacey simulates the spread of disease by using networks of animal contact. While she never uses actual farm locations or animal movements because of security and privacy, she creates simulated networks that reflect the characteristics of the agricultural enterprise. These models are a tool to allow epidemiologists and policy-makers to pose scenarios and conditions to see how the model predicts the possible spread patterns.

Stacey says this research will help public health officials and farmers determine risks to the industry and eventually reduce them.

Stacey has recently extended the model to include avian diseases.

—Mallory Kohn and Rebecca Wilson

Collaborators include Caroline Dube, Neil Harvey, Greg Klotz, Saira Ahmad and Le Nguyen.

SHARCNET, the Canada Foundation for Innovation, the Canadian Food Inspection Agency, Colorado State University and the United States Department of Agriculture provide funding for this research.

Prof. Mario Monteiro

PHOTO: DEAN PALMER

This vaccine fights more than one million cases of illness each year

Approved for human trials in the U.S. – a first for U of G research

With 1.3 million cases a year, the bacteria *Campylobacter jejuni* is a leading cause of food-borne illness in North America. *C. jejuni*, the bug that causes what's popularly called traveller's diarrhea, disproportionately affects children and people of developing countries. It's often contracted by consuming tainted meat products or—more often in the developing world—by drinking contaminated water.

To combat this problem, University of Guelph chemistry professor Mario Monteiro has developed a carbohydrate-based vaccine against *C. jejuni*—the first of its kind in the world. In spring 2014, Monteiro's vaccine was approved for human clinical trials by the United States Food and Drug Administration. This is the first technology developed by a University of Guelph researcher to reach this testing phase.

Developed in collaboration with the U.S. Naval Medical Research Center, the vaccine is a conjugate containing polysaccharides from *C. jejuni*. Phase 1 trials are partly finished and the vaccine has been found to be safe in humans, but it could take several years before testing is complete.

Monteiro studies polysaccharides on bacterial cell surfaces and is currently developing a sugar-based vaccine for both *Clostridium difficile* and *Clostridium bolteae*, a bacterium common to autistic children.

—India Annamanthadoo

Funding for this research was provided by the Natural Sciences and Engineering Research Council and the National Institutes of Health.

APXS

Guelph-developed technology helps explore Mars

This artist's concept features NASA's Mars Science Laboratory *Curiosity* rover, a mobile robot for investigating Mars' past and present ability to sustain microbial life.

Mars, the so-called red planet, has always been of particular interest to scientists studying space. A U of G research team, led by physics professor Ralf Gellert, has worked with a group of international scientists to develop the Alpha Particle X-ray Spectrometer (APXS), a device that measures which chemical elements, and how much of each, are in Martian rocks and soils.

APXS data is communicated to research labs at the University daily. Scientists use the data to investigate Martian rocks and sediments and to look for clues about the red planet's suitability for having sustained life.

The APXS is mounted on the arm of *Curiosity*, the minivan-sized rover roaming the surface of Mars. An earlier version of the instrument is credited as the first device to detect evidence of significant amounts (about 20 per cent) of mineralogical bound water in subsurface soils.

Evidence of water (or ice) in the subsurface of Mars came first from satellites orbiting Mars around 2000. Scientists believe this water is most likely the remnant of oceans or pools that have evaporated or disappeared into the ground as permafrost.

To look for traces of this ancient water left in the rocks, NASA landed two rovers in early 2004. Prof. Iain Campbell and Gellert developed a method to determine the water content from the rovers' APXS data collection.

Later, in 2012, NASA landed the rover *Curiosity* to learn whether Mars was ever habitable and whether simple organic traces can still be found. *Curiosity* has body-mounted instruments that need to be fed tiny amounts of a sample such as drilled rock powder or scooped soil. The APXS and other instruments, such as cameras, are selecting the most promising samples and giving geological context to the body-instrument results.

"We're investigating the samples that are deemed to be most promising ones in unprecedented detail to see how the environment about four billion years ago was on Mars, and if life could or did develop there at the same time it did on Earth," says Gellert.

—Rebecca Wilson

PHOTO: NASA/JPL-CALTECH

27

Great Lakes shoreline management approaches adopted globally

The shorelines in the Great Lakes basin are among the most dynamic ecosystems on the planet. High waves and surge during intense storms lead to intensified erosion of cohesive bluff coasts and to flooding and erosion of sandy beaches and other low-lying areas. Erosion and flooding, especially during periods of high lake levels, has caused property damage in the tens of millions of dollars along the shorelines of the Great Lakes.

In the early 1980s, U of G professors Reid Kreutzwiser and Robin Davidson-Arnott, Department of Geography, recognized that solutions to this problem required an understanding of the human dimensions and the physical processes causing the natural hazard.

In particular, Kreutzwiser completed a series of studies of shoreline management strategies and the response of property owners to coastal hazards in the Great Lakes, while Davidson-Arnott investigated the controls on bluff erosion and was among the first to recognize and measure the effect of underwater erosion of the nearshore. Together they examined shoreline erosion processes along the Great Lakes and assessed the effectiveness of existing environmental resource management policies.

Following the losses associated with high lake levels in 1985–87, they participated in interdisciplinary studies set up by the International Joint Commission and later by the Ontario government. Kreutzwiser and Davidson-Arnott made substantial contributions to the development of the Shoreline Management Policy in Ontario for dealing with the inevitable effects of water movement. This included an inventory of biological and physical features, including agricultural, commercial and private developments along the shoreline.

In addition, they developed strategies for minimizing the effects of flooding and erosion by using both active approaches, such as shore protection, and passive approaches, such as establishing setbacks and limiting shoreline development.

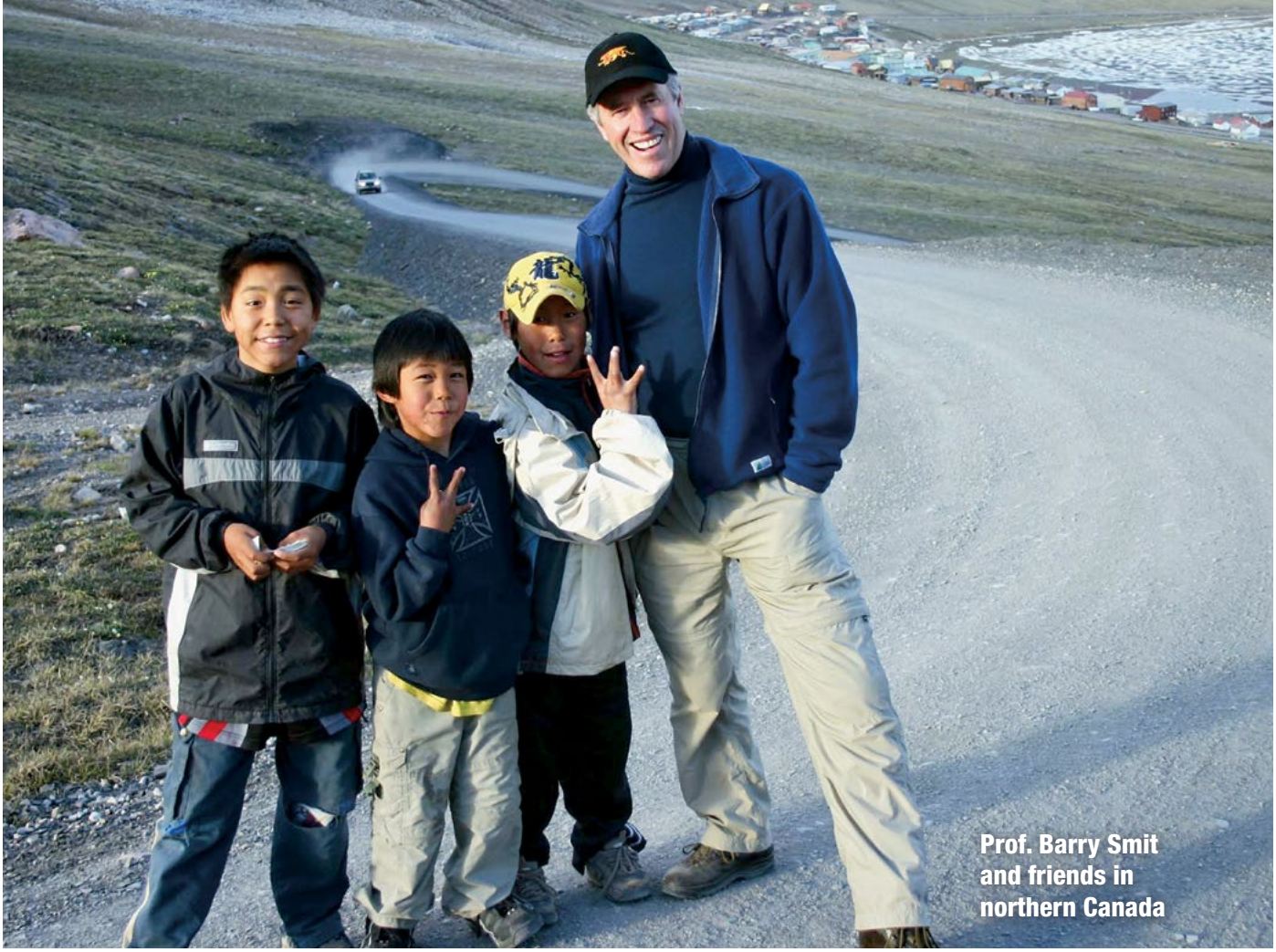
Today, these strategies are used around the world.

—Rebecca Wilson

Funding for this research was provided by the Social Sciences and Humanities Research Council and by the Natural Sciences and Engineering Research Council.

Eroded Scarborough Bluffs along Lake Ontario in Toronto

PHOTO: ORCHID POET / ISTOCK



Prof. Barry Smit and friends in northern Canada

PHOTO: COURTESY BARRY SMIT

Here's the human face of climate change

Climate change is not just an environmental issue—in fact, according to geography professor emeritus Barry Smit, former Canada Research Chair in Global Environmental Change, climate change is a social, economic, technological and political issue as well.

As one of the first researchers to investigate the human face of climate change—that is, the effects of changing temperature, precipitation and sea levels on people—Smit asked two questions: what does climate change mean for human communities, societies and economies; and how do human communities deal with this phenomenon?

Smit was one of the first scholars to numerically analyze economic impacts of climate change scenarios; then he championed work on human vulnerability and adaptation to changing conditions. Taking a participatory approach, Smit and his team worked directly with communities. They were able to find out first-hand what mattered most to the people. Responses varied, but the researchers found that people were particularly sensitive to changes in the frequency and magnitude of climatic extremes. And people adapted—usually there was no choice—but there were limits to adaptation. Climate change was already harming livelihoods and lives in many parts of the globe.

Smit's work has led him to 68 countries and dozens of towns and villages in some of the most remote and underdeveloped regions in the world. In the Arctic, Smit worked alongside scientists from Canada, the United States, Greenland, Iceland, Norway, Sweden, Finland and Russia. Together, they researched 21 sites affected by climate change, and collected information from community members, archives and organizations to better understand the social adaptation that accompanies climate change.

Today, his concepts are widely used by researchers, governments and development organizations across Canada and around the world. As a member of the Intergovernmental Panel on Climate Change, Smit was a co-recipient of the 2007 Nobel Peace Prize, and in 2013 he was appointed to the Order of Ontario and was awarded the Gold Medal from the Social Sciences and Humanities Research Council.

—Rebecca Wilson

Promoting equal access to justice

At the University of Guelph's Centre for the Study of Social and Legal Responses to Violence (CSSLRV), researchers are collaborating with community organizations, federal and provincial governments, and criminal justice agencies to help prevent or reduce various forms of violence. Canada Research Chair and sociology professor Myrna Dawson established this centre to create, mobilize and promote knowledge about effective responses to violence. The core focus of the CSSLRV is violence against women, including intimate partner violence and homicide, which most often affect women.

A major component of Dawson's research focuses on access to resources for victims and perpetrators of intimate partner violence (IPV). Dawson defines resources not only in practical terms—such as counselling and shelters—but also in terms of government policies and how they prioritize and determine responses to IPV in the community, the criminal justice system and society.

"For those experiencing intimate partner violence, there are a lot of resources available … but we haven't looked at whether these resources are available to everyone," says Dawson.

She is building a data set that documents all Ontario homicides since the 1970s by collecting information on a number of key characteristics. Dawson calls the data set "unique worldwide," given its depth of information and the length of time it covers. Once completed, it will be used to match homicide cases based on similar characteristics in order to compare the availability and utility of resources for victims and perpetrators in those communities, as well as the variations in criminal justice outcomes.

Following that, surveys and focus groups will be held to help interpret and explain the findings. Dawson's goal is to understand what factors or resources have the greatest impact on trends in IPV.

As a member of Canada's first-ever Domestic Violence Death Review Committee, Dawson also focuses on bridging the gap between recommendations and policy implementation in IPV. With collaborators at Western University, she has helped to establish the Canadian Domestic Homicide Prevention Initiative (www.cdhpi.ca).

She hopes her research will help Canada achieve equity in available resources and responses supporting those who are experiencing intimate partner violence across the nation.

—India Annamanthadoo

Prof. Myrna Dawson (seated) and graduate student Janine McKall

PHOTO COURTESY OF MYRNA DAWSON

Funding for Dawson's research is provided by the Canada Research Chair program, the Social Sciences and Humanities Research Council, the Canadian Institutes of Health Research and the Canada Foundation for Innovation.

Among her collaborators are CSSLRV research associate Tina Hotton, Dr. Peter Jaffe of Western University and numerous graduate students, including Julie Poon, Sarah Cahill, Guila Benchimol, Danielle Sutton and Jordan Fairbairn.

More information about the CSSLRV can be found at www.violenceresearch.ca.

A panel from Prof. Evan Fraser's new graphic novel, *#foodcrisis*

ILLUSTRATION: SCOTT MOONEY FROM *#FOODCRISIS*. REPRINTED WITH PERMISSION

The challenge of feeding nine billion

As the world's population climbs toward the nine billion mark, global food security has become a major issue among experts, producers and consumers alike.

Contributing to this conversation at Guelph is geography professor Evan Fraser, who holds the Canada Research Chair in Global Food Security.

While Fraser's work explores this issue from a range of perspectives, one topic he and his colleagues have been working on is the role of alternative food systems—such as farmers' markets, small-scale farms and urban agriculture—and the role they could play in our day-to-day lives.

As he sees it, one of the problems with these alternative food systems is that they must be scaled up to meet the demands of consumers.

And in doing so, many of the very characteristics that made them alternative are often lost.

"We must match up what consumers expect out of shopping for food with what farmers need when they sell their products," says Fraser. "Consumers expect convenient and cheap options that farmers aren't always set up to give."

Scientists need to engage directly with producers to identify the gaps, needs and challenges to developing agricultural technologies for international use.

One solution the team is studying is food hubs. These are often co-operatively owned facilities that aggregate, process and distribute locally produced food. Food hubs give farmers the ability to reach larger buyers (such as universities or hospitals) and provide consumers with the option of convenient, fresh local produce. They also help regional farmers compete with large retailers.

Fraser's international research focuses on policy strategies for meaningful development for small-scale producers. He argues scientists need to engage directly with producers in different parts of the world to identify the gaps, needs and challenges to developing agricultural technologies for international use.

Fraser also works to communicate this research with non-academic audiences. He has just published a graphic novel on global food security to complement his two popular non-fiction books and his animated video series that has been watched more than 100,000 times.

In 2014, he and colleagues from across campus hosted the first "feeding nine billion challenge" that asked teams of students to develop tools to reduce food waste. This event will be repeated provincewide in 2015 and nationwide in 2016.

—India Annamanthadoo

www.feeding9billion.com

The Sandwich Generation

Helping to balance work and family

In today's changing and aging society, it's not uncommon for workers—both men and women—to be taking on more responsibilities. In addition to full-time employment, many of these workers are caring for children, for aging parents or both.

The Centre for Families, Work and Well-Being is focusing on the economic and health consequences of work stress and overload.

Caring for aging parents while raising kids is a challenging task.

PHOTO: D13 / SHUTTERSTOCK

How do they manage?

This is the question Prof. Donna Lero, Department of Family Relations and Applied Nutrition and Jarislowsky Chair in Families and Work, is investigating as she delves into the work–life balance challenges of this "sandwich generation."

Lero is focusing on the economic and health consequences of work stress and overload. She is also determining how government policies, workplace practices and community services can improve productivity and engagement at work and better support those providing care to young children, seniors and family members with a disability.

In 1998, Lero and Kerry Daly, former dean of the College of Social and Applied Human Sciences, co-founded the Centre for Families, Work and Well-Being. This multidisciplinary, innovative research and educational centre engages faculty and graduate students in high-quality research designed to promote individual and family well-being, responsive and productive work environments, and strong, sustainable communities.

Lero believes that supporting individuals to effectively manage their work and personal lives can have positive effects on workplace performance, health, family relationships and communities. She and others at the centre have used their research findings to help influence businesses to provide more flexible work hours, to inspire communities to provide high-quality child-care programs, and to inform government policies related to parental leave and caregiving.

—Rebecca Wilson

Funding for this research is provided by the Social Sciences and Humanities Research Council, various government departments and the Jarislowsky Foundation.

PHOTO: MACHINE HEADZ / ISTOCK · PHOTO-ILLSUTRATION: GARETH LIND

Connecting self-injury and social media

Between 14 and 24 per cent of teenagers and young adults have reported self-injury at least once in their lifetime. That's the same demographic that uses the Internet—primarily for social networking—more than any other age group.

This association between Internet use and self-injury is one of the research areas of psychology professor Stephen Lewis. He's taken a particular interest in understanding how youth communicate about self-injury on YouTube and the impact this may have, given that it's among the major social networks.

Lewis has led a team looking at YouTube videos about non-suicidal self-injury—that is, the intentional damage of one's body tissue that is not accompanied by suicidal intent. The researchers found that videos about self-injury, including cutting and burning, may have both risks and benefits. Among the risks are that some videos may normalize or even reinforce self-injury. At the same time, many youth use YouTube and other social networks to obtain needed support and acceptance when this is not always available offline.

Findings from this line of research led to the development of Self-injury Outreach and Support (SiOS), which Lewis co-founded and co-directs. SiOS is an international outreach organization providing information and resources about self-injury to individuals who self-injure and to those who have recovered, as well as to their caregivers and families, friends, teachers and the health professionals who work with them.

SiOS (www.sioutreach.org) allows individuals to share their recovery stories online as well as their motivation to recover.

—Anna Wassermann

Lewis' research is supported by the Canadian Institutes of Health Research. His lab also has infrastructure support from the Canada Foundation for Innovation.

Identifying poor nutritional practices

In Canada, as many as 15 to 20 per cent of young children aged 18 months to five years old are nutritionally at risk. Poor nutrition in children can cause physical and developmental problems and lead to poor lifelong nutritional habits.

To help counter this problem, professor emerita Janis Randall Simpson of the University of Guelph's Department of Family Relations and Applied Nutrition (FRAN) and former FRAN professor Heather Keller worked with the Sudbury and District Health Unit to develop NutriSTEP®, a licensed nutrition screening program for toddlers and preschoolers.

NutriSTEP® is made up of two 17-item questionnaires – one for toddlers and one for preschoolers – that alert parents to good nutritional practices by allowing them to evaluate their child's nutrition-related habits. The questionnaires focus on dietary intake, eating habits, developmental feeding issues, supplement use, physical activity, TV-watching, and computer and video-game use.

By scoring their answers, parents can determine which aspect of their child's health needs improvement.

The program is used in Ontario, New Brunswick and Alberta, and by Dietitians of Canada as Nutri-eSTEP.

—Anna Wassermann

Omega-3 milk and cheese

Guelph put the "Oh!" in dairy

Dairy Oh! milk, popularly seen in the dairy case of many Canadian grocery stores, was developed at the University of Guelph to address the dietary shortage of two essential fatty acids, docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA).

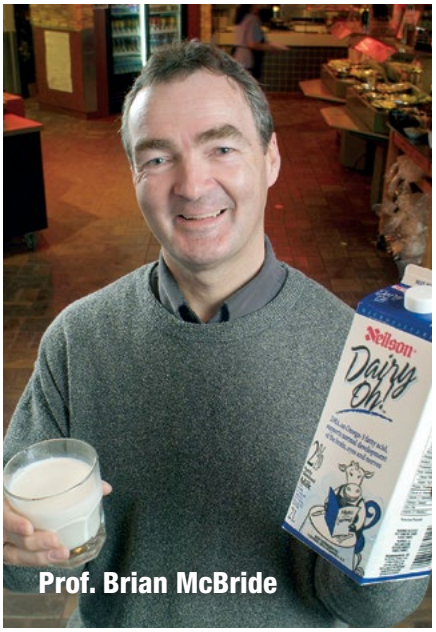
These fatty acids are vital for neural development, general health and cardiovascular disease prevention among both young and old alike. In nature, they're found in abundance in fish. But not everyone is a fan of fish, and as a result, many people, especially children, suffer from DHA shortage.

University of Guelph professors Brian McBride and Bruce Holub discovered that giving cows a diet enriched by fish meal would make the animals' milk and cheese an excellent DHA source.

To achieve this, McBride, Holub and former animal and poultry graduate student Tom Wright developed a patented process that protects the DHA in the fishmeal or fish oil from degradation in the rumen, which serves as the primary site for microbial fermentation of ingested feed in ruminant animals.

—Rebecca Wilson

This research was sponsored by the Natural Sciences and Engineering Research Council and the Ontario Ministry of Agriculture, Food and Rural Affairs.



Prof. Brian McBride

PHOTO: MARTIN SCHWALBE

Essential fatty acids in your milk

PHOTO: NIPAPORN PANYACHAROEN / SHUTTERSTOCK

Left: OAC Bayfield soy has contributed more than $750 million to Ontario's economy. It won Seed of the Year in 2013. Right: Guelph Millennium was named Seed of the Year in 2005.

PHOTOS: SHUTTERSTOCK · COURTESY DAVID WOLYN

OAC Bayfield and Guelph Millennium

Key successes from Guelph's plant breeding program

Ontario's agri-food industry—the largest in Canada—thrives on research, which is underlined by advances in the development of novel plant varieties.

Public breeding programs, such as the one at the University of Guelph, have played a critical role in the cultivation and evolution of many niche market crops into major commodities.

Of the program's many developments, both the OAC Bayfield soybean and the Guelph Millennium asparagus have experienced unprecedented commercial success and longevity.

OAC Bayfield, developed in 1993 by crop science professors Jack Tanner and Wally Beversdorf and their team, is a one-of-a-kind soybean whose progeny continues to thrive today.

This soybean has contributed more than $750 million to Ontario's economy. Through partnership with SeCan, the University has received approximately $1 million in seed royalties, much of which has been re-invested in research.

Because of its superior genetics in terms of seed quality and protein content, OAC Bayfield has been used in crosses to further the development of improved varieties—such as OAC Wallace, OAC Champion and OAC Kent.

Also stemming from Guelph's plant breeding program is the Guelph Millennium asparagus, developed by Prof. Dave Wolyn, Department of Plant Agriculture. Thriving in heavier soils than most varieties, Guelph Millennium has enabled asparagus production to expand into previously unsuitable areas.

Guelph Millennium was named Seed of the Year in 2005 by the seed industry, recognized for its sustained high yields, adaptability and overall vigour. This popular cultivar now comprises more than three-quarters of the Ontario market and has achieved high levels of success elsewhere as well, including the major asparagus-producing state of Michigan, where half of all the asparagus grown is Guelph Millennium.

—Rebecca Wilson and Alexandra Sawatzky

Funding for this research is provided by the Ontario Ministry of Agriculture, Food and Rural Affairs, Agriculture and Agri-Food Canada, Asparagus Farmers of Ontario, Agricultural Adaptation Council, Grain Farmers of Ontario, and seed companies and organizations including SeCan.

Rocks for crops

A root cause of falling per-capita food production in sub-Saharan Africa is the declining quality and quantity of soils. Soil quality and quantity are the basis for food security, employment and overall survival in many developing countries.

But how can such a basic and yet complex material be rejuvenated? U of G professor emeritus Peter van Straaten, School of Environmental Sciences, says these soils require nutrients such as phosphorus, calcium and magnesium.

Van Straaten has spent most of his career studying agrominerals—geological materials that contain one or more recognized plant nutrients. He investigates ways to use these materials to support a viable and more sustainable rural agricultural economy.

Most smallholder farmers in Africa appreciate the nutritive value of water-soluble fertilizers for plants. However, they can rarely afford them. So van Straaten has looked to locally available rocks and minerals, as well as organic resources that also offer nutrients.

For example, he found that phosphate (a major source of phosphorus in rocks) combined with organic manure is an effective and relatively inexpensive source for improving fertility in nutrient-depleted soils. The phosphate is obtained by crushing the rock into dust-size particles and then working it into the soil.

This research has resulted in a dramatic increase in soil productivity for thousands of small farmers in East Africa. In parts of Kenya and Tanzania, these alternative methods have increased corn production of smallholder farmers from one tonne per hectare per year to as many as three tonnes per hectare per year.

—Rebecca Wilson

Funding for this research was provided by international development agencies including the International Development Research Centre.

Phosphate can have a significant effect on plant growth, as this corn plant (right) from Uganda shows.

PHOTO: PETER VAN STRAATEN

Alternatives for a depleting environment

Setting the pace for bioproduct development

Environmental problems created by petroleum-based products have researchers at the University of Guelph's Bioproducts Discovery and Development Centre (BDDC) working to replace traditional plastic with bio-plastic and bio-based polymers.

BDDC researchers are pushing the boundaries of material science, engineering and chemistry to create new, environmentally friendly products.

A particular focus for the BDDC is the automotive industry and creating more sustainable materials for car parts at a lower cost. To achieve this, researchers test new materials under stringent conditions, such as in boiling water or under UV light, to see how they react to different variables.

BDDC's goal is to create more sustainable materials that will both perform well and last. For instance, car-part materials should be able to last through both a long, cold Canadian winter and a hot Arizona summer.

Most recently, the BDDC has also created affordable, eco-friendly consumer goods. The most successful so far are flowerpots containing recycled plastics and up to 30 per cent bio-fibres. The flowerpots, which contain bio-fibres from miscanthus grasses, exemplify BDDC's goal of creating new bio-resin composites that can meet or exceed the physical characteristics of traditional plastic and be more cost-effective.

The flowerpots have demonstrated that it's possible for bio-composite products to achieve both economic parity and the mechanical characteristics of plastic.

Jill Selby (left) and Amy Thatcher, Department of Plant Agriculture, are pictured here with a bio-composite flowerpot made with U of G technology.

PHOTO: SPARK

—Rebecca Wilson

Funding for the BDDC is provided by the Ontario Ministry of Agriculture, Food and Rural Affairs; the Canada Foundation for Innovation; Ontario Research Fund, Research Excellence, Round-4 from the Ontario Ministry of Economic Development and Innovation; the Canadian Agricultural Adaptation Program from Agriculture and Agri-Food Canada and the Federal Economic Development Agency for Southern Ontario; the Natural Sciences and Engineering Research Council; the Hannam Soybean Utilization Fund; and Grain Farmers of Ontario.

38

50,000 citrus and mango trees, 600 jobs

Improving sustainability for impoverished communities

Ghana, located in sub-Saharan Africa on the Gulf of Guinea, is a country beset with immense poverty, chronic food insecurities, and poor health and nutrition. But by working in numerous Ghanaian communities and with researchers at the Kwame Nkrumah University of Science and Technology, Guelph environmental sciences professors Andrew Gordon and Naresh Thevathasan have helped improve the status quo—and the future.

Their project, Agroforestry Practices to Enhance Resource-Poor Livelihoods (APERL), was created in 2006 to strengthen Ghana's vision of becoming West Africa's centre of excellence in agroforestry. APERL's goals included increasing food production and harvests using agroforestry practices, providing clean water sources, extending forest cover and decreasing forest fires, enhancing biodiversity and, overall, alleviating famine by creating income generation opportunities for men, women and youth.

APERL was hugely successful. Interested households were supplied with more than 50,000 mango and citrus fruit tree seedlings, fodder and timber trees, and initial breeding livestock, such as pigs, goats and sheep. Participants were educated through hands-on training workshops and focus groups on topics such as managing farm animals, livelihood planning, record keeping, and budgeting.

APERL also helped to construct tree nurseries, charcoal kilns and household mushroom production units to encourage continuous income generation to achieve food security in project communities.

And through education and the creation of a voluntary firefighting squad, fire belts around the farm communities were created, resulting in fewer fires and associated damage by 90 per cent.

APERL is credited with creating more than 600 jobs in farming and academia, the latter by training 15 graduate students in Ghana and Canada. —Rebecca Wilson

Funding for this project was provided by the Department of Foreign Affairs, Trade and Development (formerly the Canadian International Development Agency).

PHOTO: CLAUDIA D / ISTOCK

Making a difference in animals' lives

From left, graduate students Jeanine Santos Da Silva and Michelle Hunniford, research assistant Linda Caston and Prof. Tina Widowski with enriched chicken cages

PHOTO: MARTIN SCHWALBE

Participants at the Campbell Centre for the Study of Animal Welfare (CCSAW) have spent the past 25 years researching, educating and promoting high welfare standards for all animals used or affected by humans—including food, laboratory, companion and zoo animals and wildlife.

CCSAW scientists focus on using objective measures to assess the quality of life of animals used by humans, and based on their research, policy-makers are able to make more thorough decisions and create new codes of practice pertaining to improving animals' well-being.

Professor emeritus Ian J.H. Duncan was the first holder of the University Chair in Animal Welfare and was one of the pioneers in animal welfare science. He was a leader of the "feelings-based approach" to animal welfare, as he helped to develop techniques for "asking animals" how they feel about the environments they are kept in.

For instance, he discovered that hens prefer to lay their eggs in an enclosed nest box and that they would even work to push through weighted doors to access a nest. Understanding how animals think and feel can lead to better living conditions and treatments.

The CCSAW director and current University Chair in Animal Welfare, Prof. Tina Widowski, is working on developing best practices for the care, housing and management procedures for farm animals. Her research includes topics such as housing systems for pregnant and farrowing sows and weaning practices for piglets. Widowski also tackles tougher issues such as the transport, slaughter and euthanasia of these animals.

Most recently, she has been researching a more economical and sustainable housing alternative for laying hens. Enriched cages give hens a more livable and spacious alternative, providing them with nests, perches and scratch areas while maintaining the health, hygiene and production benefits of traditional cages.

Research by Duncan and Widowski, along with seven specialized faculty, more than 40 CCSAW associated faculty and more than 50 graduate students across the colleges, has led to huge advancements in the study of animal welfare and has helped Canada maintain its place as a global competitor in animal production and agriculture.

—Rebecca Wilson and Mallory Kohn

Funding for this centre comes from private donations and industry grants and sponsorships. Revenue is also generated by offering in-class and field training seminars to off-campus groups, including the Ontario Society for the Prevention of Cruelty to Animals.

Research associate Tom Graham (left) and Prof. Mike Dixon with controlled atmosphere technology

PHOTO: SPARK · MARS PHOTOILLUSTRATION: VADIM SADOVSKI / ISTOCK

Food: the next frontier in space

"In 20 to 30 years, humans will be growing plants for food on Mars."
—PROF. MIKE DIXON

A vital and challenging step for space crews heading to Mars is the development of a sustainable food system. Given the vast distance from Earth to Mars and the significant difficulties in resupplying an exploration mission, food must be able to be grown on a planetary base or astronauts will not be able to survive the mission.

At the University's Controlled Environment Systems Research Facility—a lab funded in part by an investment from the Ontario Innovation Trust, the Canada Foundation for Innovation and the Ontario Centres of Excellence—Prof. Mike Dixon and his team are growing plants in hypobaric (low-pressure) chambers.

Conditions inside each of the 2½-metre-tall chambers are controlled by computer-automated systems that allow researchers to vary watering, humidity, carbon dioxide levels, plant nutrition, temperature, light and atmospheric pressure.

This facility is the most sophisticated and largest research venue in the world for studying plant and microbial interactions in advanced life support systems. And Dixon feels confident he and his team will reach their goal.

"In 20 to 30 years, humans will be growing plants for food on Mars," he predicts.

Dixon has also formed the University of Guelph's Space and Advanced Life Support Agriculture program, which currently represents Canada's primary biological life support contribution to the international space program and provides opportunities for his industry partners to exploit new technologies for commercial benefits here on Earth.

—Rebecca Wilson

They host therapeutic antibody production

Using tobacco plants to help fight cancer

Tobacco is notorious for causing cancer, but now it's helping to fight it. Tobacco plants are being modified to create a version of the breast cancer antibody trastuzumab (trade name Herceptin), which stops tumours from growing and encourages the body's immune system to attack. Based on the results from mouse model testing, this plant-based antibody is as effective in reducing the size of breast cancer tumours as the animal-based Herceptin.

Prof. Chris Hall of the School of Environmental Sciences at the University of Guelph has developed the recombinant antibody technology used to create the plant-produced antibody. A Guelph firm, PlantForm, is licensing this technology, which would see tobacco plants serve as a host for the production of therapeutic antibodies.

Drug production typically involves using bioreactors, such as large fermentation chambers, to grow organisms such as bacteria and yeast, which are used to produce antibodies of vaccine. PlantForm, however, genetically engineers tobacco plants as substitute bioreactors that include genes that make the antibodies.

Tobacco plants are used for several reasons. Their molecular biology and genetics are well understood, and they have the same cell systems as humans. In addition, they're economical to grow because they can produce large quantities of antibodies on a small footprint. Overall, this is a product that can significantly help cut health-care costs.

Today, Hall and his team are looking to develop other low-cost, plant-made alternative antibodies designed to combat colorectal cancer, head and neck cancer, and HIV/AIDS.

— Rebecca Wilson and Katharine Tuerke

Funding for this project was provided by the Ontario Ministry of Agriculture, Food and Rural Affairs, the Natural Sciences and Engineering Research Council, the Ontario Centres of Excellence and the National Research Council of Canada Industrial Research Assistance Program.

PHOTO: BEELDBEWERKING / ISTOCK

Former U of G president Alastair Summerlee with the Iron Fish

PHOTO: MARTIN SCHWALBE

The Iron Fish

U of G innovation addresses iron deficiency in Cambodia

Iron deficiency is a curable, nutrient-deficient disorder affecting 3.5 billion people worldwide.

In many developing countries, such as rural Cambodia, where access to health care and treatment options is limited, the health, social and economic impacts of iron deficiency are exacerbated.

Chris Charles and Gavin Armstrong, previous and current doctoral students, respectively, of former U of G president Alastair Summerlee, found and are commercializing a simple, cost-effective solution for this problem—the Lucky Iron Fish.

Cultural considerations mean standard treatments for iron deficiency and anemia are unacceptable to Cambodians living in rural villages.

Most Cambodians eat very little meat and struggle to get their daily iron requirements. Regular use of iron supplements will correct this deficiency, but due to the unpleasant side effects, women rarely use them.

In many rural areas, there are also distribution problems. So, the supply of these iron supplement pills is not always guaranteed.

Elsewhere in the world, it has been shown that iron deficiency anemia can be treated with regular use of cast iron pots or pans. However, women in Cambodia prefer to use aluminum pots because they are lighter and less expensive.

The Guelph researchers discovered that iron placed in the cooking pots will leach from the piece and into the water and food during cooking. At a cost of $5 U.S., the Iron Fish—with a design chosen to represent the local river fish considered lucky in Cambodia—was relatively inexpensive and meshed well with the culture.

After the Iron Fish was used in cooking for several months, results looked positive.Women reported feeling better—which they attributed to the luck of the fish—and, after six months, their blood tests began showing significant increases in iron levels.

The Iron Fish—with its translation from idea into reality—has improved the health and wealth of many people. But it has had an impact beyond helping people affected by iron deficiency. Today, the Lucky Iron Fish™ Company, which was founded by Armstrong, is a successful business with a socially driven ethos. The company continues to investigate and create effective and sustainable business models that have the ability to impact people's live in many spheres.

—Rebecca Wilson

Funding for this research was provided by the Students for Development Award, the Association of Universities and Colleges of Canada, an Ontario Graduate Scholarship, the International Development Research Centre, the Canadian Institutes of Health Research, Guelph Commercialization Fellowship and the University of Guelph.

Breast cancer

Moving toward a cure

Breast cancer is the most common form of cancer among Canadian women, representing nearly 25 per cent of all new cancer cases each year. Treatment options have improved dramatically in recent years, but there's still much work to be done.

For biomedical sciences professor Roger Moorehead, increasing the effectiveness of breast cancer treatment involves an understanding of how cell receptors—specialized proteins that take part in communication between a cell and its surroundings—interact in developing mammary tumours.

Moorehead has devoted years to studying the insulin-like growth factor receptor (IGF-IR), which is thought to play an important role in breast cancer development. To determine the role of IGF-IR in breast cancer, Moorehead created a transgenic mouse, genetically altered to allow controlled expression of IGF-IR in mammary epithelial cells.

So far, Moorehead's research has shown the development of mammary tumours occurs rapidly when IGF-IR is expressed. That's because the receptor induces uncontrolled cell growth and prevents apoptosis (programmed cell death). As a result, tumour cells grow uncontrollably.

Moorehead's research has generated information about the effectiveness of IGF-IR therapeutic treatments for breast cancer and has provided researchers with an expanded knowledge of how tumours form and grow, allowing scientists to develop more effective targets for treatment.

Most recently, Moorehead's lab is using the transgenic mice to determine whether increasing soy protein consumption protects against mammary tumour development. In this study, the team is administering different amounts of soy to the mice at different stages of development to determine the best recommendation for soy consumption in humans.

—Anna Wassermann

This research was sponsored by the Canada Foundation for Innovation, the Ontario Research Fund, the Canadian Institutes of Health Research, the Canadian Breast Cancer Alliance, the Canadian Breast Cancer Foundation – Ontario Region, the Cancer Research Society and the Canadian Cancer Society.

The Fox Chase SCID beige mouse

SCID

A model for better understanding human disease

Severe combined immunodeficiency (SCID) is a genetic disorder characterized by the absence of functional T- and B-lymphocyte cell systems, which are the major cellular components of the adaptive immune response.

SCID is the result of an immune system so highly compromised that it is considered almost absent. Patients suffering from the disease are usually affected by severe bacterial, viral or fungal infections early in life and often present with interstitial lung disease, chronic diarrhea and failure to thrive.

Nearly 20 years ago, University of Guelph professor Anne Croy developed a research mouse called the Fox Chase SCID beige mouse. This mouse, which possesses both genetic autosomal recessive mutations (SCID) and beige, defective natural killer (NK) cells, has led researchers to better understand important disease mechanisms.

Immunodeficient research models help with a wide range of biomedical research, including immunology (the study of the immune system) and oncology (the study of tumours).

Fox Chase SCID beige mouse has proven to be useful for tumour biology, infectious disease research and transplant studies. The animal's unique vulnerability has also helped researchers understand important disease mechanisms.

—Rebecca Wilson

Licence agreements for this mouse were negotiated with Charles River Laboratories International, Inc., Taconic Laboratory and Harlan Laboratories.

45

Hamburger disease

Controlling and identifying toxins

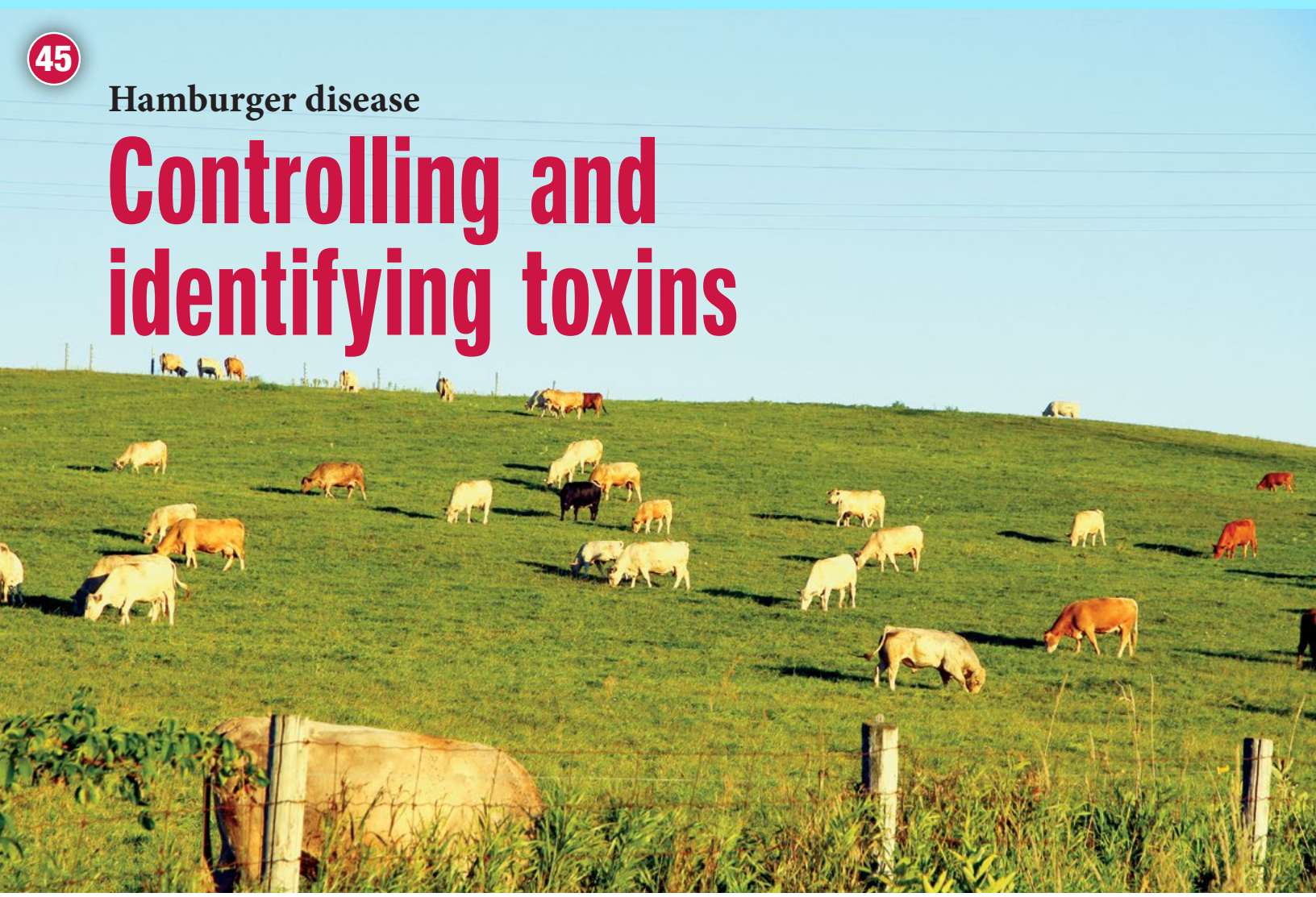


PHOTO: VALESTOCK / SHUTTERSTOCK

Prof. Carlton Gyles

PHOTO: MARTIN SCHWALBE

Hamburger disease, caused by verotoxigenic *Escherichia coli* (VTEC), was named for its association with the consumption of undercooked ground beef patties containing a pathogenic *E. coli*. First described in Canada in the 1980s as an emerging food-borne disease, VTEC can cause severe illness among humans and animals.

Professor emeritus Carlton Gyles of the Ontario Veterinary College is internationally recognized for his research on *Escherichia coli*. Specifically, Gyles investigated how various types of *E. coli* bacteria cause disease in humans and animals.

Gyles focused primarily on circles of DNA called plasmids and was the first to discover that plasmids could carry both the genes for toxins, such as the one that makes *E. coli* pathogenic to pigs and cattle, and the genes conferring antibiotic resistance.

He was also one of the first researchers to pinpoint how a toxin produced by *E. coli* could cause edema disease in pigs. In addition, he was a leader in purifying the toxin itself, which was important for developing vaccines against certain *E. coli* diseases in pigs.

Gyles' discoveries have been pivotal to the science of toxins and illness associated with *E. coli*. In 2005, Gyles was awarded the Roche Diagnostics/CSM Award, one of Canada's premier microbiology science prizes.

—Anna Wassermann

This research is sponsored by the Natural Sciences and Engineering Research Council, the Ontario Ministry of Agriculture, Food and Rural Affairs, and Agriculture and Agri-Food Canada.

She spread the word about honey's healing properties

Researcher revolutionized animal pain control

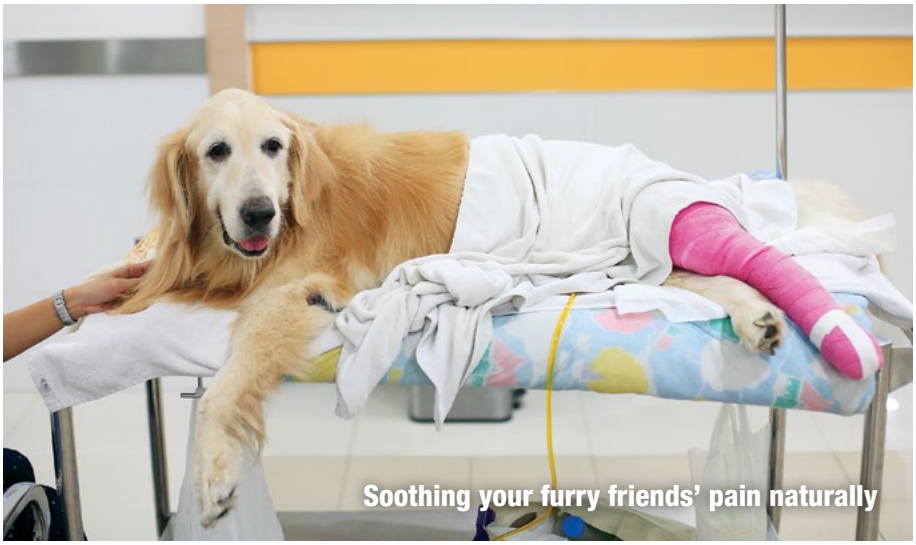


PHOTO: BLANSCAPE / SHUTTERSTOCK

Veterinarians are constantly looking for new ways to control pain and treat illness and injury in companion animals. And with Canada being home to eight million cats and six million dogs, they have their work cut out for them.

OVC professor emerita Karol Mathews devoted much of her career to ensuring hospitalized pets do not suffer pain. An emergency and critical care clinician who also trained as a veterinary surgeon, Mathews discovered numerous ways to help animals heal.

For example, Mathews advanced the understanding of how honey could effectively treat contaminated wounds and burns. After a two-day honey treatment rendered a burned animal free of further bacterial growth and cleansed of debris and dead tissue, Mathews used honey to manage other animals' wounds and spread the word of its wound-healing properties throughout the veterinary profession worldwide.

In 2004, Mathews began research on the use of albumin—a protein found in the blood of all animals and humans—to treat dogs suffering from capillary leak syndrome. This treatment now provides veterinarians with an extremely effective tool for treating companion animal illness.

Mathews' research and discoveries have changed the way veterinarians control pain in their patients. She is also widely recognized as a pioneering influence in veterinary emergency and critical care for developing ways to treat critically ill pets.

—Anna Wassermann

Broadening the scope of cancer research for animals

The University of Guelph's Ontario Veterinary College has been serving animals for more than 150 years. Thanks to an integrated approach to cancer research and the establishment of a new animal cancer treatment centre, the Mona Campbell Centre for Animal Cancer, Guelph has made huge strides in treating animal cancer in the last decade.

Launched in 2007, the Institute for Comparative Cancer Investigation (ICCI) involves the collaborative work of more than 30 cancer investigators across a dozen different disciplines. Cancer biologists, veterinarians, chemists and others are working together to broaden the scope of cancer research and deepen our understanding of cancer.

In 2012, five years after the launch of the ICCI, the Mona Campbell Centre for Animal Cancer was opened thanks to support from OVC Pet Trust. This included a large donation made by the estate of the late Mona Campbell, a longtime animal advocate and supporter of the University.

Today, the centre is Canada's most comprehensive animal cancer treatment and research centre and offers the most advanced tools for cancer diagnosis, treatment and teaching. Patients have access to therapy, clinical trials and state-of-the-art technology similar to that used in human medicine.

Scientists at the centre are able to perform animal cancer research to deepen our understanding of the disease in both humans and animals.

For example, researchers have found a way to use viruses to treat animal cancer. Current cancer treatments are direct and target known affected areas. But treatment with viruses is designed to seek out cancer cells in the whole body and eliminate them.

—Anna Wassermann

Research at the Institute for Comparative Cancer Investigation and at the Mona Campbell Centre for Animal Cancer is sponsored by OVC Pet Trust, which recently completed a campaign that raised more than $13.5 million.

48

Prof. Bonnie Mallard (right) and Semex vice-president Brad Sayles with Dairy Expo innovation award

PHOTO: MARTIN SCHWALBE

Identifying healthier herds

The immune system, in both humans and animals, is essential for survival due to its ability to destroy disease-causing micro-organisms and pre-cancerous cells. Those individuals with the ability to make robust and balanced immune responses are termed high immune responders, often respond better to vaccines and, overall, are less likely to get sick.

At the University of Guelph, a research team has developed a safe, accurate way to help identify cows with the strongest, most disease-resistant immune response systems.

Led by Prof. Bonnie Mallard of the Department of Pathobiology, this High Immune Response (HIR) technology helps to identify cattle as high, average or low immune responders.

High responders are those that have naturally more enhanced and balanced immune responses, capable of defending against the large number of diverse pathogens that commonly infect dairy cattle. These cows also have better-quality milk and colostrum, containing more protective immunoglobulin and other defence molecules.

HIR is a genetic test with high heritability—it need be done only once at any stage of the animal's life from two months of age onward. The high immune response genes are passed on to future generation of offspring to continue to improve herd health.

The test involves three farm visits in which blood or milk samples are taken from the cows and their skin-fold thickness measured. They are also immunized with two different proteins. The animal's ability to respond to the test antigens determines its immune response.

High immune responders have up to 50 per cent lower incidence of disease than low immune responders,

49

Presponse vaccine

The shipping fever vaccine standard

Bovine respiratory disease (BRD), also known as shipping fever, is the most common and costly problem encountered in feedlot calves. Stress, altered diets and exposure to other calves can harm the immune system, leaving calves vulnerable.

Conventional pneumonia vaccines were not only ineffective; their use was associated with higher risk of disease. University of Guelph pathobiology professors emeriti Patricia Shewen and Bruce Wilkie took a new approach by focusing on the antibodies of the calves that escaped pneumonia.

After extensive research, Shewen and Wilkie discovered that pneumonia bacteria create a toxin and other factors that attack immune cells in the lungs. Their vaccine, known commercially as Presponse, works by inducing antibodies to these factors – something previous vaccines had never been able to do.

After entering the market in 1988, the Presponse vaccine quickly became the most effective method of shipping fever pneumonia prevention. It protects cattle from mortality and morbidity, while reducing the need to use antibiotics and enhancing animal welfare.

A major Canadian innovation in the field of cattle health management, Presponse has become the standard by which other bovine respiratory vaccines are now measured. Shewen and Wilkie revolutionized cattle disease prevention and saved producers millions of dollars. They have been nominated for many prestigious awards, including the Ernest C. Manning Award for Innovation in 2012.

—Anna Wassermann

including important economical diseases such as mastitis and pneumonia.

The HIR test can also be used to identify sires with the best immune responses, and these sires are marketed by the Semex Alliance under the trade name Immunity+. Results of the HIR technology have enabled producers to cull cattle with low-immune response profiles and to select more appropriate bulls for breeding, based on the immune profiles of both sire and dam.

—Rebecca Wilson

Funding for this research was provided by the Ontario Ministry of Agriculture, Food and Rural Affairs, the Natural Sciences and Engineering Research Council, and the Canadian Dairy Network.

Foundational research for the current HIR technology for cattle was done by Mallard, Prof. Bruce Wilkie and the late Brian Kennedy, using pigs at the Arkell research station.

The research was sponsored variously by grants and contracts to Shewen and Wilkie from the Medical Research Council, the Natural Sciences and Engineering Research Council, Agriculture and Agri-Food Canada, the National Research Council, Langford Laboratories and the Ontario Ministry of Agriculture, Food and Rural Affairs, which shares ownership of the Presponse vaccine with the University of Guelph. The commercial rights to Presponse currently belong to Boehringer Ingelheim Vetmedica Inc.

A closer look at animal embryo biotechnology

Advancements in reproductive technologies form an important component of the University of Guelph's heritage and contributions to livestock productivity and agricultural research.

Instrumental in driving this research forward is Prof. Allan King, Department of Biomedical Sciences, and his research team at the University's Reproductive Health and Biotechnology Laboratory. Over the years, King has refined in vitro techniques that allow embryos to be studied from their earliest stages.

"We want to understand what makes embryos develop well, while also identifying causes of embryo failure or death," says King. "We found that genes can be uniquely expressed—or expressed at different levels—from the moment of fertilization."

Although his main goal is to improve fertility and reproduction in domestic animals of agricultural significance, King's research also has beneficial implications for human medicine and management of endangered species.

One of King's most revolutionary discoveries was that, from the very beginning, male and female embryos develop differently and have unique patterns of gene expression. For humans, this offers a potential explanation for the differences between males and females in the incidence of certain diseases.

—Alexandra Sawatzky

Current collaborators come from many areas of expertise, including Profs. Jon LaMarre and Pavneesh Madan of the Department of Biomedical Sciences; Prof. Tracey Chenier, Department of Population Medicine; Dr. Gabriela Mastromonaco, curator of reproductive programs at the Toronto Zoo; research associates Dr. Laura Favetta and Dr. Tamas Revay; and lab technicians Elizabeth St. John and Ed Reyes.

Major funding sources for King's research include the Canada Research Chair program, the Natural Sciences and Engineering Research Council, the Canadian Institutes of Health Research, Agriculture and Agri-Food Canada, and the Ontario Ministry of Agriculture, Food and Rural Affairs.

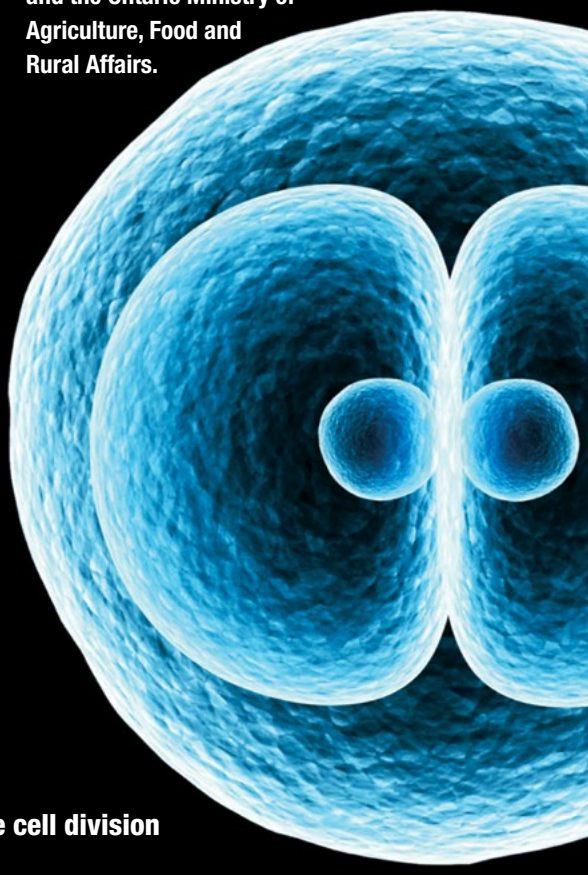


PHOTO: RAJ CREATIONZS / SHUTTERSTOCK

Zygote cell division

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