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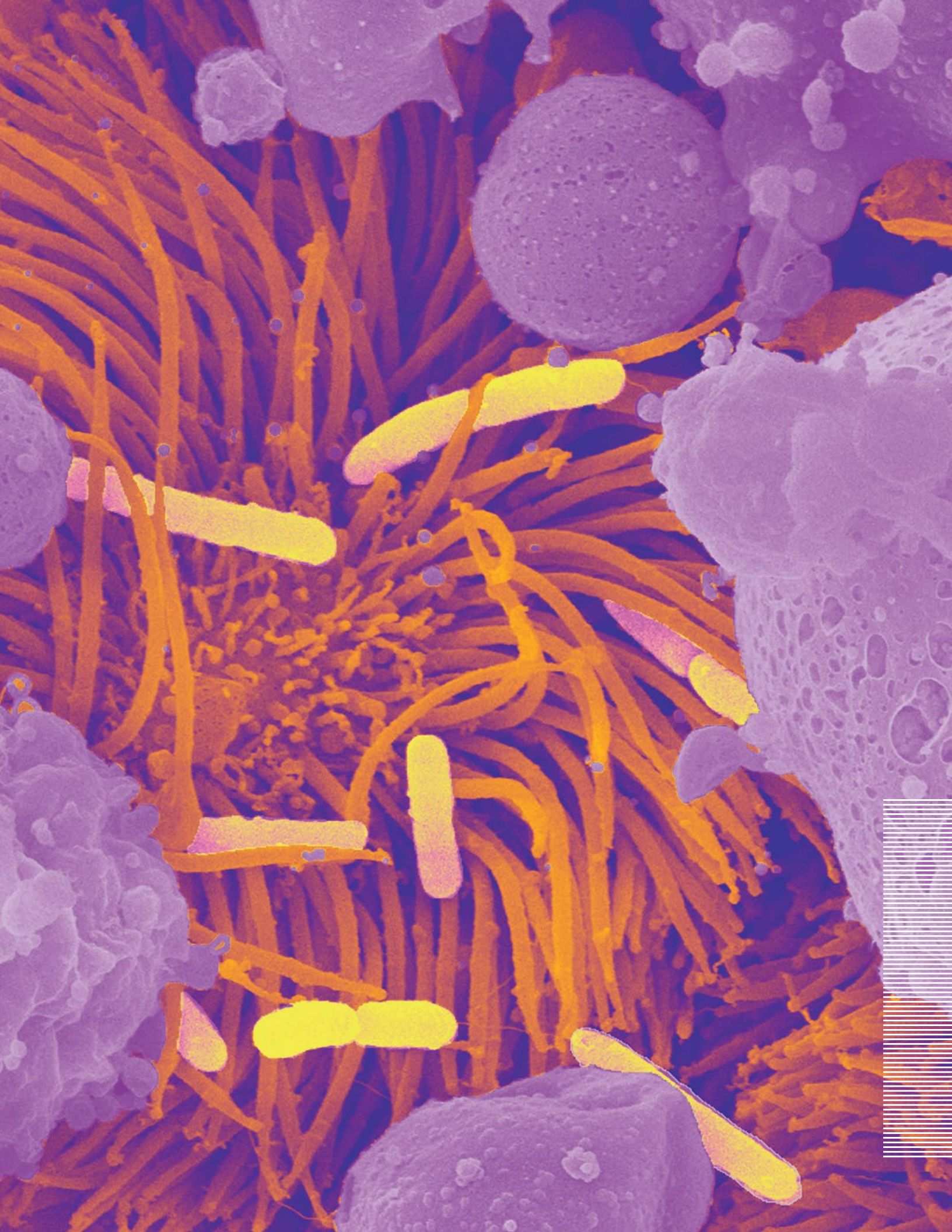
research

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Eating better and living longer

Chronic *Pseudomonas* infections are a major problem in humans with cystic fibrosis, whose lungs produce too much fluid. Studying the behaviour of such cells (highlighted in yellow) in the tracheal cells of mice gives researchers clues about how to treat these infections. Prof. Cezar Khursigara and Dr. Amber Park captured this image using a false-coloured scanning electron microscope at the Khursigara laboratory in the Department of Molecular and Cellular Biology.



A healthy outlook

“Here’s to your health.” So goes the common toast—a wish for times of good fortune ahead. It’s a fitting toast, as our good fortunes are so inextricably tied to our health.

Health is frequently associated with merely being free of disease. The World Health Organization takes a broader view, defining health as *“a state of complete physical, mental, and social well-being, and not merely the absence of disease or infirmity.”*

We share that broad view of health here at the University of Guelph. Health requires safe nutritious food,

a sustainable environment, and a vibrant, functioning society.

We bring our comprehensive research strengths to bear to understand the many facets of health—its underpinnings, its challenges, and its sustenance—from the level of molecules to that of whole populations.

This comprehensive approach to the understanding of health is an

immense strength of the University of Guelph. It differentiates us from many universities conducting health research.

Unlike many universities, where health-related research is conducted largely in a medical school, health-related research is found right across the University of Guelph—in all seven of our colleges. Undoubtedly, that’s because health research at the University of Guelph has deep roots that go right back to our founding colleges—the Ontario Agricultural

College, the Ontario Veterinary College, and the Macdonald Institute—with a direct and applied human health connection, through food, agriculture, nutrition, and, of course, veterinary medicine research.

Today, health research at the University of Guelph extends well beyond that found at traditional medical schools. For starters, our research considers a wide range of animal species—from companion animals and livestock to wildlife—as well as humans, of course.

Crucially, University of Guelph health research examines the interplay between animal, human, and environmental health—the continuum sometimes referred to as “One Health”—and uses our discoveries to consider how best to support healthy ecosystems and healthy society.

Over the years, progressive research sponsors, like-minded in their approach to health, have supported Guelph’s research efforts. They include the federal Tri-Council Agencies and the Ontario Ministry of Agriculture, Food and Rural Affairs.

From fundamental understanding of disease emergence and new technologies for disease prevention and treatment, to the ways that we represent and understand health and the policies we derive to sustain it, University of Guelph researchers are at the front lines of health research.

On the following pages, I invite you to sample Guelph’s many aspects of health research. I’m sure that you will agree that this “healthy outlook” is one that will improve life for us all. Here’s to your health!

University of Guelph health research examines the interplay between animal, human, and environmental health—the continuum sometimes referred to as “One Health”—and uses our discoveries to consider how best to support healthy ecosystems and healthy society.

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An inside job

Prof. Emma Allen-Vercoe, Molecular and Cellular Biology, talks about her lab's work with the gut microbiota of pigs

| Elisabeth Aerts

Q What is the goal of your research?

A Our research is intended to improve the microbiota—that is, the ecosystem of bacteria within the gut—of unhealthy pigs.

Q What previous knowledge did you have about these ecosystems?

A It's known that the microbiota of people can affect their susceptibility to disease. So supporting a healthy microbiota may help prevent the development of disease.

Q Those bacteria play an important role in our health, then. How did you decide your work with humans could be applied to pigs?

A For us, it was a natural next step. We knew that contributors to unbalanced—and therefore, unhealthy—microbiotas in other animals. We chose to develop treatments for pigs based on a need to improve their well-being, to help farmers in turn to improve their products. Pork is a substantial export for Canada so we hope to be able to help both the animals and their producers.

Q Sounds like people and pigs have some similarities! What was the first step in helping the pigs?

A First we found a herd of farmed wild boar near Stratford that are antibiotic-free and that forage outside all year round—it's their natural diet, supplemented with farm-grown berries, soy and corn. The animals were considered to be extremely

healthy because their microbial ecosystems had developed naturally without intervention. The next step was acquiring the poop from these healthy animals. Their poop provides many important microbes that can be used to colonize domestic pig guts to increase the health of their microbiotas as well as their resistance to pathogens.

A And what's the latest?

A Right now, Valeria Parreira is growing these microbes, just as we have done with human poop. She is also identifying all of the microbes within the samples to ensure we culture only the beneficial ones for use as microbiota treatments.

Q What's the next step after you finish verifying the microbes within the samples?

A The next step will be making the microbes into a product that the pigs can readily consume. For humans, we are creating orally delivered capsules of microbes. For pigs, microbial products don't have to be quite as consumer friendly; instead, we hope that freeze-dried microbes can be sprinkled on top of their regular feed.

Q Does this mean the pigs will eat the microbes just as people do?

A Well, that's the great part about pigs, they are coprophages—meaning, they eat poop! If we can get the sows colonized by the beneficial microbes, they will defecate some of them and their babies will become colonized by eating mom's poop.

Additional collaborators include Phibro Animal Health, Guelph entrepreneur Joe Ragan and wild boar producer Fred De Martines. This research is funded by the Gryphon's LAAIR program.



**“Overall, the wild turkeys we examined appeared to be in good health. We now have a snapshot of the potential disease-causing organisms that may be carried by healthy-appearing wild turkeys in Ontario.”
—Prof. Nicole Nemeth**

Clean bill of health for these birds

Farmers and hunters worry about the potential for disease to spread between wildlife such as wild turkeys, and domestic livestock, such as poultry. The concerns are warranted, given how quickly disease can race through an on-farm herd and create huge losses.

But research into the health status of Ontario wild turkeys (*Meleagris gallopavo silvestris*)—which many producers in the province welcomed onto their farms during the birds’ reintroduction here in the 1980s—has given this species a clean bill of health.

A post-mortem of 152 wild turkeys, provided by hunters during a one-month period in 2015 to pathobiology graduate student Amanda MacDonald and Prof. Nicole Nemeth of the Ontario Veterinary College (OVC), showed either no amount or only marginal amounts of many of the infectious agents that can lead to some of the more well-known diseases that also affect domestic turkeys.

These diseases include avian influenza, one of the most feared diseases in poultry production. The researchers found no incidence of it—nor any salmonella—in the wild turkeys in their study.

Other disease agents detected in minute quantities included campylobacter and avian poxvirus. And one case of antibiotic-resistant bacteria was found. *E. coli* was shed by about three-quarters of the birds. But it was the standard form of the bacteria that is common in the digestive tracts of humans and other animals.

Mycoplasma and coccidia were also commonly found, in additional

tests conducted with the research lab of OVC professor John Barta and the Animal Health Laboratory at the University of Guelph. So were reticuloendotheliosis virus and lymphoproliferative disease virus. However, these potential disease-causing agents appeared not to be a problem, either.

“Overall, the wild turkeys we examined appeared to be in good health,” says Nemeth, who along with Barta is part of the University’s Poultry Health Research Network. “We now have a good snapshot of the potential disease-causing organisms that may be carried by healthy-appearing wild turkeys in Ontario.”

That’s good news for producers, hunters and anyone who appreciates ecological diversity. The most recent wild turkey count, from 2007, puts the population at around 70,000. But despite these numbers, information about the wild turkeys’ health status is scarce.

With such a high population, the Ontario Ministry of Agriculture, Food and Rural Affairs – University of Guelph Partnership, which supported MacDonald’s and Nemeth’s study, was anxious to see whether the prolific wild birds harboured disease and were likely to cause problems with their domestic counterparts—or vice versa.

So far, this doesn’t seem to be the case.

“From a wildlife health perspective, it is really encouraging to see that wild turkeys in Ontario appear to be doing well and, hopefully, will continue to have sustainable populations,” says MacDonald.

—Owen Roberts

Addressing school-related difficulties of youth with psychiatric illness

Many barriers to academic achievement, such as high anxiety in the classroom and discomfort in social situations, are faced by young people returning to school after an absence caused by psychiatric illness.

“They have to catch up on missed school work and try to re-establish relationships, and are regularly met with uneasiness and sometimes stigma from their peers and teachers,” says Prof. Michèle Preyde, Department of Family Relations and Applied Nutrition.

She is collaborating with mental health experts who identified the need for this research to try to better understand the complex shift youth experience upon school re-entry, and what can be done to improve this transition.

Specifically, they are examining the

experience of youth aged eight to 18 years, who have been hospitalized for psychiatric illness for an average of just over a week. Survey responses by the youth and their parents about their concerns for returning to school, and their real experiences upon doing so, have been revealing.

For example, youth were particularly worried about social encounters, and some youth reported being socially isolated and lonely. Youth also reported difficulty with their academic standing and managing their symptoms. Many reported being overwhelmed, and requested

assistance with learning how to cope. Several youth also reported being bullied.

“Our goal is to assist this population directly by attempting to facilitate school re-entry, and improve mental health literacy in the community and the identification and management of mental health disorders. We hope to reduce or prevent their escalation or negative impact on the youths’ educational outcomes and quality of life,” she says. “For some youth, continuity of care is an issue requiring further exploration.”

—Elisabeth Aerts

Collaborators on this project include Dr. Shrenik Parek and Dr. John Heintzman, who are psychiatrists at Grand River Hospital.

The project was partially supported by the Community Engaged Scholarship Institute with in-kind support from Preyde and personnel from Grand River Hospital.



Making music without a score

Researchers unite individuals to create an engine for healthy communities

What do you do for members of a society who are becoming less attached to the people around them?

University of Guelph researchers suggest we look to the arts to bring people and communities together.

Ajay Heble, a professor in the School of English and Theatre Studies and director of the International Institute for Critical Studies in Improvisation (IICSI), studies the social, political and cultural implications of bringing together a group of people to create their own music.

“What we’re doing is unique in the

world. We’ve propelled Guelph into a world centre for improvisational music as a form of social practice, an engine for change,” Heble said.

Researchers at IICSI -- previously known as the Improvisation, Community and Social Practices program -- have discovered that individuals who can express their creativity and develop their musical and artistic skills are better able to work together for extended periods, negotiate differences, trust others and follow through on their responsibilities.

“Our work is exploring how

improvisational arts-based practices contribute to the development and flourishing of healthy communities, as well as how these practices help communities understand identity, history, memory and the body,” said Heble.

Working with the KidsAbility Centre for Child Development, a program for children with complex special needs, researchers are documenting and analyzing how specific improvisational activities affect socialization, self-esteem, physical coordination and intelligence.

IICSI involves more than 50

researchers from 20 academic institutions around the globe, as well as more than 30 community partners. Working for social change through arts, scholarship and teamwork, the institute aims to improve self-confidence of youth and adults, and promote teamwork, trust and negotiation.

—Alyssa Logan

IICSI is funded through the Social Sciences and Humanities Research Council’s Partnership Grant program.

10 things to know about the Centre for Cardiovascular Investigations

| Anna Wassermann

The Centre for Cardiovascular Investigations (CCVI) combines expertise in cardiovascular biology and clinical medicine. It provides a comprehensive, multidisciplinary environment to support and enhance basic, translational and clinical cardiovascular studies.

1. Collaboration

The CCVI brings together researchers in the Ontario Veterinary College and the College of Biological Science. By working at the molecular and clinical levels from the University and beyond, they ensure that every aspect of cardiovascular health is covered. With more than 100 cardiovascular scientists, clinicians and students from the University of Guelph and across the country, the CCVI is enhancing heart health on local and global scales.

2. Education

CCVI faculty teach a wide variety of undergraduate and graduate courses that help students pursue careers as scientists, health-care providers and clinicians. CCVI runs a seminar series about faculty cardiovascular research to promote networking among grad students and to attract top undergraduate students interested in cardiovascular and health sciences research. The Centre also runs a distinguished cardiovascular scientist lecture series and an annual research day to allow top external experts to network with its members. In turn, these activities promote CCVI research with leading decision-makers nationally and internationally.

3. Translation

About 1.6 million Canadians live with cardiovascular disease, which costs the Canadian economy more than \$20.9 billion each year in physician services, hospital costs, lost wages and decreased productivity. Using cutting-edge molecular and physiological approaches, including cardiac imaging and preclinical trials, CCVI members are learning more about cardiovascular disease and new therapeutic strategies to improve the lives of Canadians.

4. Social Media

A website (www.uoguelph.ca/CardiovascularResearch), a LinkedIn page (CCVI Guelph) and a Twitter account (@CCVIGuelph) inform the public of CCVI developments. Biomedical sciences professor Tami Martino investigates circadian rhythms and heart disease, and her group has created several media sites to help inform researchers and the public. A blog about chronobiology (chronobioapp.blogspot.ca) helps patients discuss optimum timing for medications with their doctors. Another blog called CircaSNP (circasnp.wordpress.com) discusses how circadian gene mutations may affect health and disease. The circadian microarray database (circadianmicrorna.com) showcases their latest genetic discoveries in heart health and disease. The Centre also runs a news feed that highlights discoveries and activities of faculty and students (www.uoguelph.ca/CardiovascularResearch/NEWS.html).

5. Global

CCVI faculty and students have received more than \$50 million in external research funding as well as numerous awards and partnerships. They have been awarded more than \$12 million in the last five years alone. Research funding to CCVI investigators is awarded through grants from the Canadian Institutes of Health Research, Heart and Stroke Foundation of Canada, Natural Sciences and Engineering Research Council, OVC Pet Trust, Canada Foundation for Innovation, and Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA).

6. Innovation

Innovative cardiovascular research holds great promise for discovering new approaches to treat and prevent heart disease. Prof. Glen Pyle, Biomedical Sciences, studies the molecular mechanisms of heart failure, including aging, hormones and cardiac myofilaments. His lab is developing novel therapeutic agents to treat heart failure, using targets identified in molecular research.

Integrative biology professor Todd Gillis studies how hagfish hearts function without oxygen. His work may help protect against ischemic heart disease, in which blood flow to the heart is reduced.

Prof. Jeremy Simpson, Department of Human Health and Nutritional Sciences (HHNS), studies models of heart failure in mice to investigate the effects of the disease on diaphragm function—the ability of the diaphragm muscle to contract and relax, allowing us to breathe.

In the Department of Molecular and Cellular Biology (MCB), Prof. John Dawson uses zebrafish to examine the effects of mutations on cardiac actin, a protein involved in many important cellular processes including muscle contraction.

8. Practical

Our blood vessels can adapt in size and stiffness to meet our body's demands. CCVI research into the benefits of exercise on blood flow is crucial to athletic performance and response to heart disease.

A project led by HHNS professor Jamie Burr looks at whether rigorous exercise among over-trained athletes may lead to stiffening of the arteries. Prof. Coral Murrant, HHNS, studies how blood vessels communicate to ensure healthy structure and function of our skeletal muscles and other tissues. MCB professor Nina Jones, holder of the Canada Research Chair in Eukaryotic Cellular Signalling, investigates signal transduction in blood vessel formation, embryonic development, kidney function and nervous system patterning.

7. Veterinary

Reflecting the University of Guelph's strategic research direction to promote health and well-being, the CCVI works to identify treatments for both humans and animals. Clinical studies professor Lynne O'Sullivan uses echocardiography for early diagnosis of cardiomyopathy in dogs, especially Dobermans. She works with Centre members to develop biomarker tests to better diagnose and treat animals with this fatal disease. Clinical studies professor Sonja Fonfara is looking at heart muscle changes in cats with cardiac disease, which could help in understanding how the disease progresses in humans. Prof. Peter Physick-Sheard, Population Medicine, studies atrial fibrillation, a common and deadly disease involving irregular heart rhythm in performance horses and people. These clinical studies not only lead to better heart health management for animals, but they will also benefit human patients with cardiovascular disease.

9. Integration

More than 60 per cent of Canadian adults and 31 per cent of youth are overweight or obese, putting them at increased risk of diabetes and high blood pressure—two of the most common risk factors for heart disease. CCVI researchers are examining how external conditions affect our heart rate and blood pressure and how our bodies regulate blood flow to better control stressors that contribute to obesity. One project led by Martino examines how maintaining sleep and our daily circadian rhythms in intensive care units is crucial for optimal recovery after heart attacks. The group also investigates how the heart's circadian rhythms point to potential new treatment strategies for cardiomyopathy, hypertension and heart failure, and for promoting healthy heart aging. HHNS professor Philip Millar looks at how dietary nitrate in beetroot juice may lower blood pressure at rest and in response to exercise. His lab has also developed novel diagnostic tools for determining sympathetic activity in humans, which is an important measure of health and disease.

10. Dedication

Avoiding foods high in saturated fat, sodium and cholesterol reduces your risk of heart disease. But certain foods may be better at warding off heart disease than others. CCVI researchers and collaborators are examining the benefits of resveratrol, a natural substance found in red wine, for shift workers whose physiology is interrupted by working long or unusual hours. They also study the effects of sleep apnea on the heart and restorative approaches to reverse the disease. Prof. Tarek Saleh, Biomedical Sciences, investigates how the central nervous system regulates heart rate, blood pressure and neuro-hormones in cardio-cerebral and other diseases. He is also developing novel nutraceuticals to benefit patients clinically. Studies in clinical pharmacology by biomedical sciences professor Ron Johnson may help optimize drug treatments for animal and human patients. Investment in partnerships with OMAFRA, industry and key funding agencies will lead to more projects like these and help improve the health and welfare of Canadians.



Prof. Gonzalez-Morales records her savouring experiences in an Instagram account (@savouraholic) while travelling and enjoying culinary experiences.

Make work a healthy experience

Think positive

| Alaina Osborne

Feeling overwhelmed, overworked and offended by rude behaviour at work can lead to stress and reduced productivity among employees. But what can be done about it?

That's what Prof. Gloria Gonzalez-Morales, Department of Psychology, is trying to figure out. She's the director of the Occupational Health and Positive Psychology Lab on campus that aims to better understand and manage mental well-being in the workplace.

"People spend a lot of time at work; it's a huge part of life," she says. "We're trying to figure out how people can have the most positive experiences and create a positive work environment."

Gonzalez-Morales and her research team use online surveys to examine students' and

employees' experiences before and after stressful situations. They also use long-term diary questionnaires to follow employees' experiences daily, weekly and monthly.

At the Centre for Workers' Health and Well-Being on campus, team members may study how willing participants react to stressful scenarios in order to learn how potential stressors, such as an increased workload or a new task, may be seen as either a threat or an opportunity.

Researchers have found that seeing challenges in a more positive light relates to better performance.

"Work doesn't have to be miserable," says Gonzales-Morales. "Our research can lead to solutions, such as training for employees and employers to help them enjoy their work and regulate their emotions. Workplace stress has a huge influence on well-being."

Five Rs for reducing stress at work

1 Recover your resources. Take time to recover after work by doing other activities. At a minimum, detaching physically and mentally from work each day can prevent the cumulative effects of daily stress.

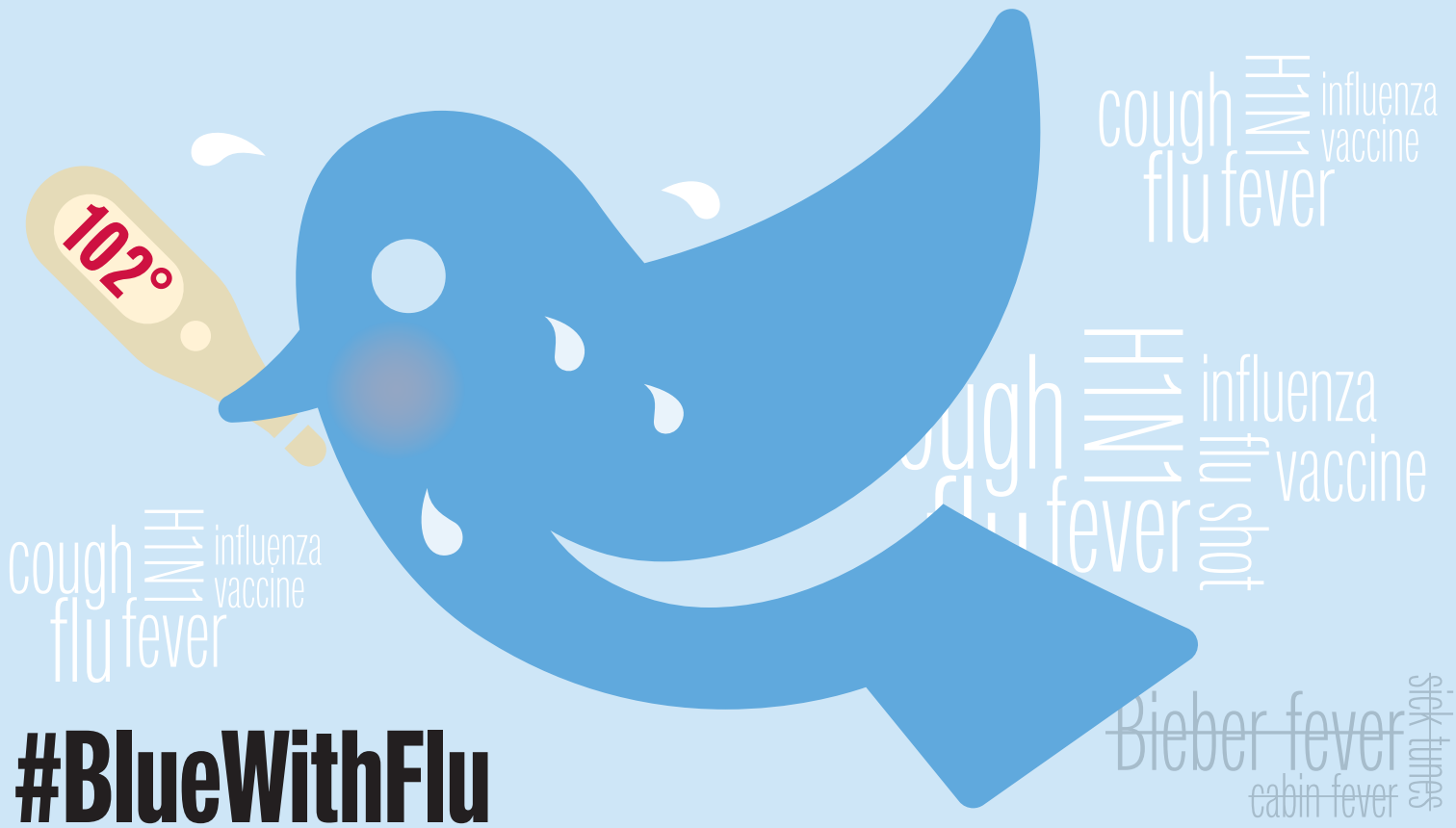
2 Regulate your emotions. Strong and negative reactions to sources of pressure prevent clear thinking about successful ways to deal with difficult situations. Practising emotion-regulation skills—such as mindful awareness and acceptance of any current moment, positive reappraisal of negative experiences and savouring positive thoughts and feelings during and after positive situations—can support mental fitness.

3 Request help. Dealing with stress requires that you invest resources to address demanding situations. Sometimes we need to ask supervisors and co-workers for those resources, which may be instrumental (an extra team member to help with the load) or emotional... like a hug.

4 Reconsider stress as a challenge to grow and learn. When we have enough resources to deal with work situations (especially if we regularly practise the above suggestions), stressful situations may become opportunities to demonstrate our competencies or to learn new ones.

5 Retreat. Sometimes the only solution to a stressful situation is to leave it. When we lack control over the situation, we need to analyze it, learn as much as possible to prevent it from happening again and leave before it drains more of our available resources.

This research is supported by the Social Sciences and Humanities Research Council, the Canada Foundation for Innovation, and the Ontario Ministry of Research, Innovation and Science.



#BlueWithFlu

Social media helps researchers track disease outbreaks, locally and globally

| Amy Westlund

Hash-tagging your flu season blues could help track disease outbreaks, especially among millennials, says a University of Guelph researcher.

Adam Beswick, an M.Sc. student in epidemiology in the Ontario Veterinary College's (OVC) Department of Population Medicine, says that when millennials get sick, their first reaction may be to tweet about it rather than see a doctor, where flu cases are normally recorded and reported.

That means there may be valuable information to be gained by exploring online platforms for disease surveillance for this tech-savvy age group.

"Social media is being used everywhere — from tracking natural disasters to social trends — so it's only a natural step for it to be used in public health research," says Beswick. "Canadians are among the highest social media users in the world. We're very well connected online."

Disease surveillance is crucial for public health organizations to track the spread of infectious diseases and effectively recommend preventive measures.

For his pilot project, Beswick is focusing on human influenza. It's a common

disease and a hot discussion topic on Twitter.

He says Twitter is an excellent source of data, as many of the roughly 500 million tweets posted daily are publicly available. This activity allowed him to collect 400,000 unique tweets posted from every province and territory between August 2013 and July 2014.

He selected tweets based on one or more of 17 specific keywords, such as "flu," "influenza," "cough," "fever," "vaccine" and "H1N1."

Certain types of tweets correlated more with true flu activity than others. Specifically, non-retweets (written directly by a user) and tweets without a URL link performed better than their counterparts.

Beswick had to confirm the context of keywords, such as an unexpected summer spike in the use of "fever" in tweets discussing unrelated topics such as "Bieber fever" or "cabin fever."

A large increase in influenza-related keywords in December and January mirrors the typical winter spike of flu cases measured by FluWatch.

More tweets including "flu shot" were posted in October — when many people receive flu shots — and again in January,

when some may have regretted not getting the shot.

Although influenza surveillance data in Canada are generally available only by province, tracking local clusters of Twitter traffic allows researchers to look at individual communities.

Tracking self-reported health information using the Internet could also fill gaps in disease surveillance among populations around the world. Information about disease may be obtained from social media, especially in locations lacking disease surveillance. Cellphone and social media use is widespread in developing countries; across Africa, cellphones are used by a large percentage of the population.

"This type of research is something that I think will be emerging in the next few decades, because of the ubiquity of Internet usage, social media and cellphone usage," he says.

Funding for this project was provided by graduate scholarships from the Canadian Institutes of Health Research and from OVC.

Collaborating members of Beswick's faculty committee are population medicine professors Cate Dewey, Zvonimir Poljak, Amy Greer and Andrew Papadopoulos.



An integrated approach to cancer studies

When the Institute for Comparative Cancer Investigation (ICCI) was launched at the University of Guelph's Ontario Veterinary College (OVC) in 2007, it was the first such facility in Canada. Still one of a kind, the institute brings together expertise in biology and veterinary medicine for an integrated approach to cancer studies that benefits both companion animals and human patients.

Like their human friends, dogs and cats can develop cancer. Many of the causes, as well as how those cancer cells behave and how we treat them, are similar, says OVC biomedical sciences professor Brenda Coomber. She has studied cancer for more than 30 years, and co-directs the ICCI with Paul Woods, a veterinary oncologist in the Department of Clinical Studies.

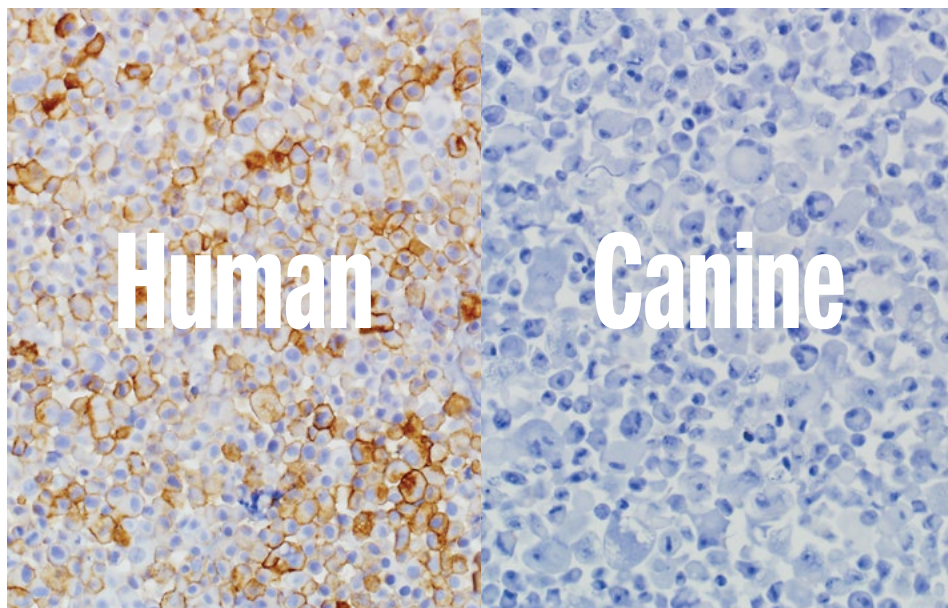
"We are studying a naturally arising disease in one species along with a naturally arising disease in another species," she says. "By taking a comparative approach, we will hopefully discover things that are not apparent when we only study cancer in humans."

The ICCI brings together researchers from across the U of G campus — veterinarians, biologists, chemists, mathematicians, computer scientists, toxicologists and psychologists — along with external groups, including experts at the University of Toronto and the University of Waterloo.

Key to this work are the world-class Mona Campbell Centre for Animal Cancer — the first Canadian facility to provide a full range of options to treat animal cancers — and the Companion Animal Tumour Sample Bank, both located at OVC. The tumour bank gives researchers access to naturally occurring cancer samples — at last count more than 18,000 tissue and fluid samples from 900 cases.

OVC is a medical school whose patients are animals instead of people, Coomber says. "As a veterinary college, we have a duty to move the field forward in the care and treatment of animals. As we broaden our understanding of cancer and improve treatment options for companion animals, we can also benefit human cancer patients."

—Karen Mantel



Immunolabelling patterns of human breast cancer cell lines serve as positive and negative controls for testing canine mammary cancer cell lines.

Improving the accuracy of lymphoma prognosis

A provisional patent has been filed for a simple blood test to predict outcomes for dogs with lymphoma, an immune system cancer that so far eludes accurate prognosis.

When tumours shrink or are killed by chemotherapy, they may release microRNAs (miRNAs) into the blood. These tiny molecules can regulate the expression of many genes.

If certain miRNAs are found in blood samples after treatment, are they accurate biomarkers for canine lymphoma?

That's what Profs. Darren Wood and Geoff Wood, Department of Pathobiology, want to know. They say that predicting a patient's response to therapy will help clinicians manage treatment more effectively and will help pet owners make better decisions.

The researchers are comparing blood miRNAs from healthy dogs with those from dogs recently diagnosed with multicentric lymphoma. This common type of lymphoma shows up as multiple enlarged lymph nodes throughout the body. From this comparison, they could learn whether specific miRNAs are linked to the disease.

They will also investigate changes in patient miRNAs during chemotherapy to identify patterns in recovery and disease, and to assess how well the molecules predict outcomes.

— Amy Westlund

Former graduate student William Gow is co-inventor in this research, which is funded by OVC's Pet Trust, the Canadian Kennel Club and the Cairn Terrier Club of Canada.

A milestone for the ICCI's tumour bank

It's 18,000 samples and counting for the ICCI's companion animal tumour sample bank (CATSB).

The bank, established in 2007, is part of the University of Guelph's Institute for Comparative Cancer Investigation. The CATSB is Canada's only facility storing animal cancer samples for future research.

The bank obtains clinical samples – blood, pieces of tumours, normal tissue and urine – from animal cancer patients treated at the Ontario Veterinary College (OVC). These samples provide invaluable resources for researchers to study cancer in dogs and cats, and to apply their findings to other species.

The bank recently obtained samples from its 900th patient.

Cancer affects many animals, and pet dogs and cats are no exception. “The tumour bank gives us an opportunity to understand the disease in other mammals, including humans, and improve cancer treatment,” says Prof. Brenda Coomber, co-director of the ICCI, who oversees the tumour bank with coordinator Dr. Kaya Skowronski.

The companion animal tumour sample bank is Canada's only facility storing animal cancer samples for future research.

After a patient's tumour is removed by surgery, samples along with normal tissue – which are usually disposed of – are conserved and stored in the tumour sample bank.

The researchers record case-specific information – age, breed and gender of the animal – as well as treatment information such as diagnosis, aggressiveness of the cancer, therapy conducted and the eventual outcome.

Collecting this range of information for each case allows researchers to complete retrospective cancer studies using samples from the ICCI tumour bank. Researchers hope that new discoveries from cancer in pets will help improve treatment of the disease in all species.

— Amy Westlund

The tumour bank and coordinator position are funded by OVC Pet Trust.

More sensitive genetic test for lymphoma

Prompt and accurate diagnosis is crucial to improve treatment for animals with lymphoma, a cancer of the lymphocytes (white blood cells involved in the immune response).

Prof. Stefan Keller, Department of Pathobiology, hopes to advance diagnostics for canine B cell lymphoma—the most common type of canine lymphoma—by developing a more sensitive genetic test.

Keller is testing the cells via their lymphocyte antigen receptors, which are highly varied protein structures on the cell surface that recognize infectious agents.

A group of cancer cells will have identical lymphocyte antigen receptors, while a group of healthy cells will be genetically diverse.

Healthy lymphocytes travel throughout the body and concentrate in certain areas to fight pathogens, and can mimic lymphoma.

Sometimes, it's difficult to determine whether those lymphocytes are part of an inflammatory response, or whether they result from a single lymphocyte dividing uncontrollably, as in lymphoma.

This is where genetic testing comes in.

Keller will use clonality testing, which involves genetically testing the cells in an affected area, to distinguish between cancer and inflammation.

This method of genetic testing will allow the researchers to work toward earlier and more accurate diagnoses of lymphoma.

— Amy Westlund

Keller is working with Dr. Nikos Darzentas, genomics researcher at the Central European Institute of Technology, Czech Republic; Prof. Dorothee Bienzle, clinical pathologist at OVC; Dr. Peter Moore, pathologist at the University of California Davis; and SHARCNET, a high-performance computing network.

OVC's Pet Trust and an NSERC discovery grant are providing funding for this project. The Canada Foundation for Innovation is providing infrastructure for Keller's lab.



New research is aimed at earlier and more accurate disease diagnosis and treatment to keep pets active and healthier longer.

Is medication effective for preventing hypotension?

The popular allergy medication diphenhydramine (DPH) is used during certain veterinary surgeries to prevent hypotension, or low blood pressure, in dogs affected by mast cell tumours (MCTs).

These tumours contain many mast cells that during manipulation in surgery release excessive amounts of histamine, a substance involved in immune response. When released into the circulatory system, histamine may cause blood vessel dilation and hypotension.

DPH, an antihistamine, is used during surgeries intended to remove MCTs. But Prof. Alexander Valverde, Department of Clinical Studies, says the medication may be less effective at preventing hypotension than once thought.

Hypotension can be prevented by blocking histamine from binding receptors on target cells. Receptors on or inside the cell receive and bind specific substances in a lock-and-key fashion. Histamine acts as a key, fitting into the lock of histamine receptors and triggering a series of signals that can lead to vessel dilation and hypotension.

DPH also acts as a key by fitting into histamine receptors in blood vessels and blocking other substances from binding.

By “locking out” histamine, the medication may prevent hypotension.

“The issue is that there are four types of histamine receptors, but DPH only blocks one of them. This means that some histamine is still able to cause blood vessel dilation,” says Valverde.

He compared cardiovascular signs and blood histamine levels of 16 canine patients with MCTs. He found similar cardiovascular function whether patients received DPH before surgery or not.

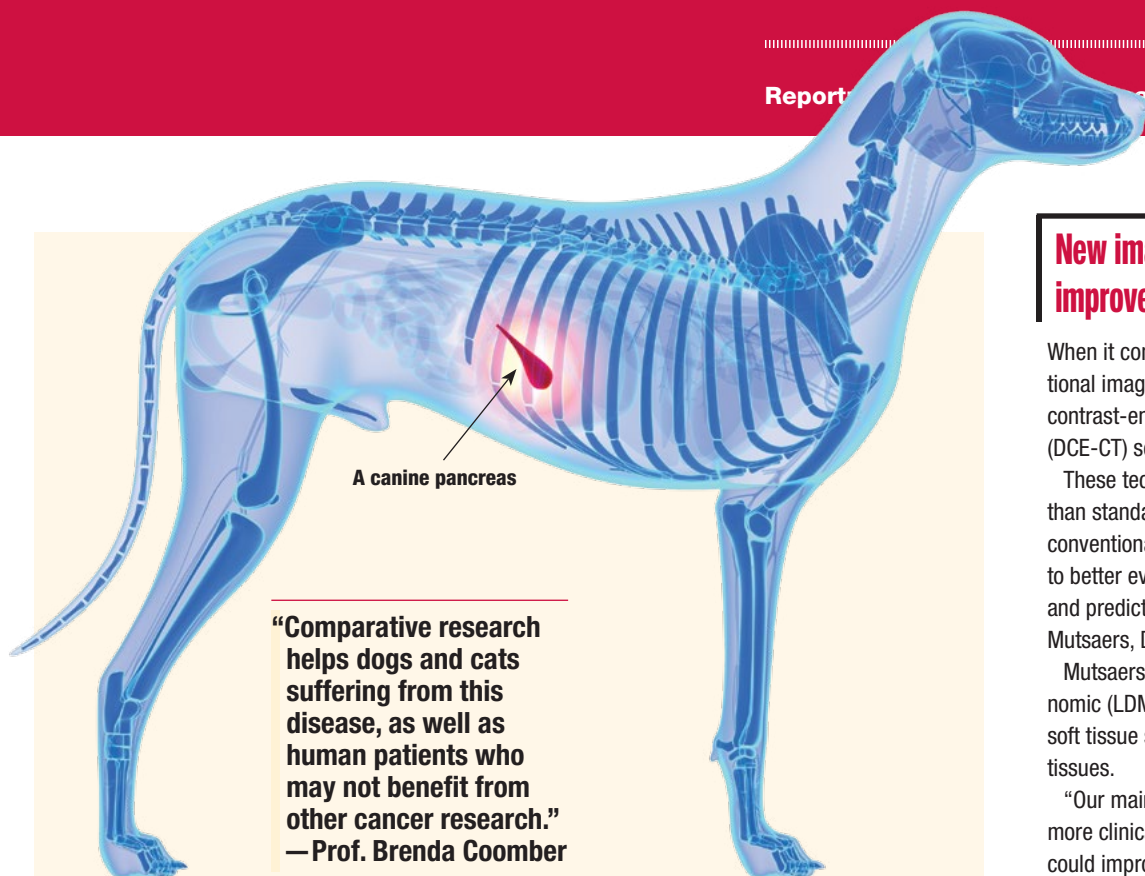
He also found that dogs not given DPH maintained better blood pressure during manipulation of MCTs than dogs receiving the medication.

Valverde says further research is needed to find an antihistamine that may block all histamine receptors and prevent hypotension.

— Amy Westlund

Valverde worked with D.V.Sc. student Andrea Sanchez and her committee members: clinical studies professors Melissa Sinclair, Conny Mosley, Tony Mutsaers and Ameet Singh; and Prof. Brad Hanna, Department of Biomedical Sciences.

Funding for this research was provided by OVC Pet Trust.



“Comparative research helps dogs and cats suffering from this disease, as well as human patients who may not benefit from other cancer research.”
— Prof. Brenda Coomber

People, pets and pancreatic cancer

Rare human cancers are often complicated by limited research and treatment options. However, canine and feline cancer patients may provide answers for rare subtypes of human cancers, and vice versa.

For example, most pancreatic cancer in humans is of the ductal type, but pancreatic acinar carcinoma (ACC) is a rare subtype of pancreatic cancer in humans. While rare in humans, ACC is much more prevalent in dogs and cats.

That’s why Prof. Brenda Coomber and Vicky Sabine studied the potential of using companion animals as models for human pancreatic carcinomas.

“Comparative research helps dogs and cats suffering from this disease, as well as human patients who may not benefit from other cancer research,” says Coomber.

Specifically, the researchers investigated the KRAS gene, which plays an important role in regulating cell growth and proliferation. Mutations in the KRAS gene are commonly seen in human cancers, including ductal

type pancreatic cancer. But human pancreatic ACC appears to lack these mutations.

Coomber and Sabine found no evidence of KRAS mutations in samples of animal pancreatic ACC from 18 dogs and 12 cats. This discovery suggests that human and animal pancreatic ACC are more similar on the genetic level than previously thought.

The researchers believe that pancreatic ACC in companion animals may be a relevant model for human pancreatic ACC, opening doors for further comparative research.

— Amy Westlund

Collaborators on this project included Dr. John Bartlett, Cheryl Crozier and Sally Stasi from the Ontario Institute for Cancer Research (OICR); Prof. Robert Foster, Jonathan Liu and Prof. Geoffrey Wood from the Department of Pathobiology; and Dr. Brian Wilcock from Histovet Surgical Pathology, Guelph, Ont.

Funding for this research was provided by the OICR and OVC Pet Trust.

New imaging system designed to improve canine cancer treatment

When it comes to cancer treatment, functional imaging technologies such as dynamic contrast-enhanced computerized tomography (DCE-CT) scans can be game-changers.

These technologies provide more information than standard tumour size measurements from conventional CT scans, allowing clinicians to better evaluate chemotherapy treatments and predict patient outcomes, says Prof. Tony Mutsaers, Department of Clinical Studies.

Mutsaers is investigating low-dose metronomic (LDM) chemotherapy to treat dogs with soft tissue sarcoma, a cancer of the connective tissues.

“Our main focus is to investigate a potentially more clinically relevant imaging system, which could improve and personalize treatment plans for animal cancer patients,” says Mutsaers.

Over four weeks, he will give dogs a daily low dose of cyclophosphamide, a drug that inhibits blood vessel growth and restricts the nutrient supply in tumours.

Using DCE-CT scanning, Mutsaers will be able to see real-time blood vessel changes within the patients’ tumours before and after the LDM treatment. Comparing those scans with blood and tumour tissue samples will help him determine how the drug may affect tumour blood flow at the chosen dose.

DCE-CT could help identify biomarkers, which are specific molecules indicating how well a patient will respond to a certain treatment. Analyzing these biomarkers would allow clinicians to determine the best treatment for any patient, he says.

He says insights from this project may eventually be applied to human medicine as well.

— Amy Westlund

Mutsaers is working with graduate student Dr. Arata Matsuyama, clinical studies professors Alex zur Linden and Michelle Oblak, and Dr. Ying-Yim Lee, director of PET/CT research at the Lawson Health Research Institute in London, Ont.

Funding for this research was provided by OVC Pet Trust.

Where art meets science

Haptic lab founders explore new ground with veterinary college partnership

At the Ontario Veterinary College (OVC), cystoscopy — a test that allows doctors to look inside an animal’s bladder with a thin, lighted tube for stones or growths for removal — has become the gold standard for performing biopsies. Although the test is used routinely, it has drawbacks: it’s expensive for pet owners, and it’s limited by the size of the patient and the camera. To Prof. Alex zur Linden, Clinical Studies, there had to be a better way.

He went looking for an alternative — something like the slim, steerable catheter (about as thick as a piece of string) used to insert pacemakers in humans.

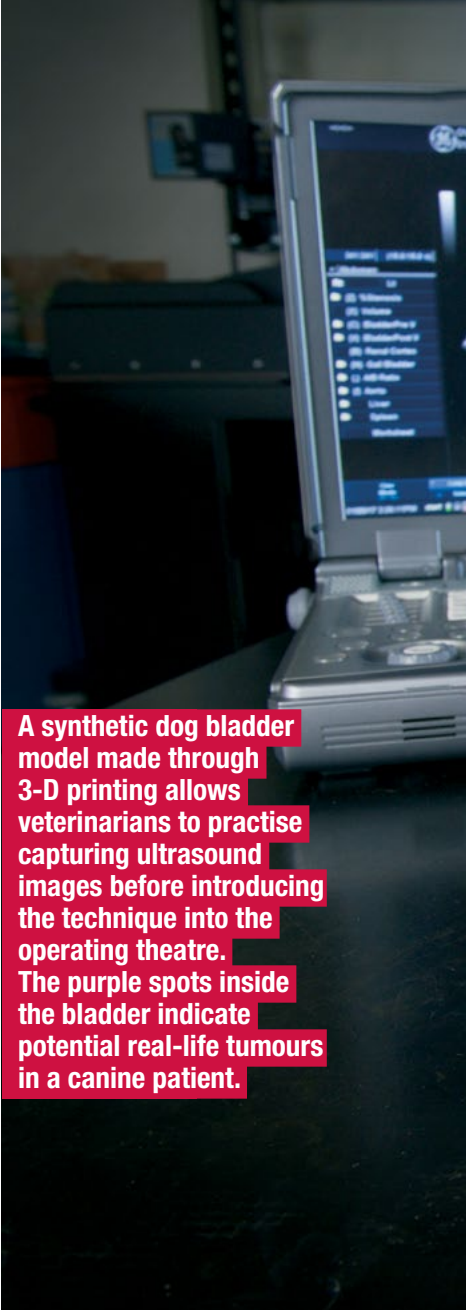
That search led him to one of U of G’s most innovative duos for assistance in developing a training model: Prof. Christian Giroux, School of Fine Art and Music, and John Phillips, College of Arts. They’ve worked together for more than a decade to solve some of the toughest design-and-build problems on and off campus (see sidebar). In 2011, they created the University’s state-of-the-art design and prototyping facility, known as the Digital Haptic Lab.

In the lab in Alexander Hall, researchers from a range of disciplines come together with their ideas. There, they find multiple 3-D printers, a water jet cutter that can slice through steel and a digital haptic

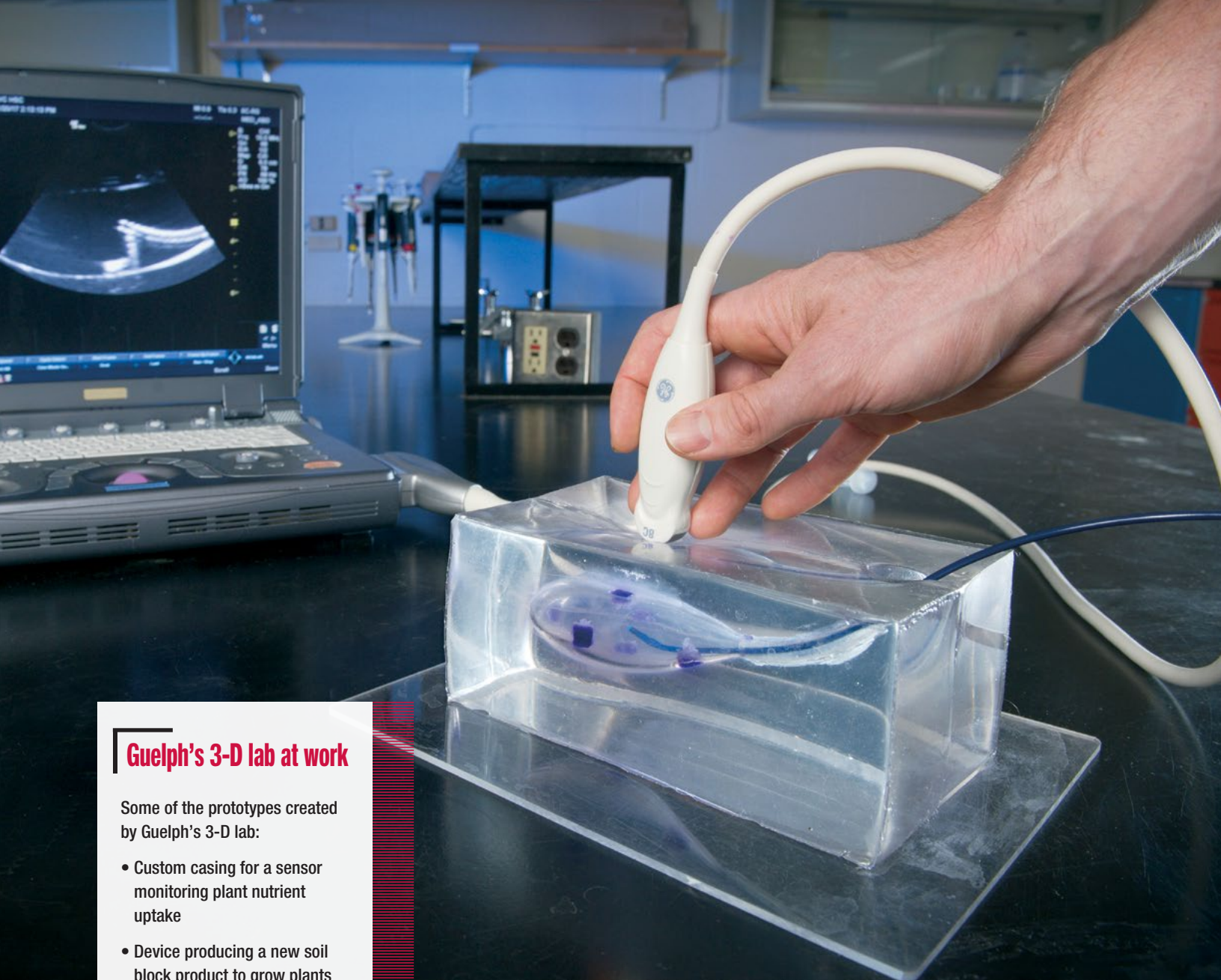
device (a virtual sculpting tool that allows users to develop unique 3-D designs on a computer). The lab helps users develop products that are otherwise impossible for traditional machinists to make.

“It’s exciting to be positioned at an interdisciplinary crossroads where we can help researchers realize their work through the production of unique gear and devices,” says Giroux. “One week we’re designing public artwork for Square One Mall and the next we’re working with researchers to design an apparatus to scan the brain of a dog.”

The work with zur Linden was their first collaboration with the Ontario Veterinary College. Phillips first developed a 3-D model



A synthetic dog bladder model made through 3-D printing allows veterinarians to practise capturing ultrasound images before introducing the technique into the operating theatre. The purple spots inside the bladder indicate potential real-life tumours in a canine patient.



Guelph's 3-D lab at work

Some of the prototypes created by Guelph's 3-D lab:

- Custom casing for a sensor monitoring plant nutrient uptake
- Device producing a new soil block product to grow plants on rooftops
- A pull tap for an artisanal cider brewing startup
- Equipment for the production of antibodies in tobacco plants to treat breast cancer
- Custom 3-D printed models of dog skulls to help veterinary oncologists plan tumour-removing surgeries, a service now available to clients of the OVC hospital
- *Nyctophilia*, a public artwork in Toronto consisting of numerous concrete poles, each sprouting several custom lamps programmed to glow in different colours and patterns

of a dog bladder. To capture the correct anatomy, they used a laser scanner to scan a physical clay model of a bladder onto a computer, and then created a design for a mould machined from aluminum.

Phillips melted synthetic gelatin in the mould, and let it set. When the gelatin cooled, he removed the mould, yielding the anatomically correct model.

Zur Linden and undergraduate veterinary student Meagan Walker have since developed a new technique to biopsy the bladder, using ultrasound instead of cystoscopy to guide the procedure. They say the bladder model was crucial for developing the technique and for learning to use the technique without involving a live patient.

Zur Linden presented their work last fall at an international radiology and oncology conference in Florida.

"Ultimately, I hope the steerable catheter will become a novel tool for performing biopsies in dogs," he says. "I also envision the model as a training tool for veterinarians, allowing them to practise various techniques before performing them on someone's pet."

Funding for this project is provided by OVC Pet Trust.

Funding for the Digital Haptic Lab is provided by the Canada Foundation for Innovation.

Also involved in this research is clinical studies professor Alice Defarges.



An action plan to address obesity

| Elisabeth Aerts

M

ore than 20 per cent of Canadian adults are obese, while most of the remaining population carries excess weight, says Health Canada. Researchers have found that obesity and its related health issues may be prevented with lifestyle changes.

But where do you start? How about with a plan?

Prof. Paula Brauer, Department of Family Relations and Applied Nutrition (FRAN), has worked with colleagues to create a framework to help physicians and their teams organize services to prevent and manage obesity.

“The plan we created, called a logic

model, considers the age, lifestyle and health of each patient, in relation to their excess weight,” says Brauer.

To develop the logic model, they studied obesity through a three-fold process.

First, they reviewed previous obesity research to evaluate the effectiveness of existing models across different stages of life and disease.

Then they created focus groups of health-care providers and patients with obesity to determine new management strategies.

Brauer and her team then met with health-care teams to review the focus

Focus group discussions showed that patients appreciated recommendations for lifestyle changes rather than simply prescriptions for medications.

group results and suggest ways to include their priorities in the planning model.

Based on its research, the team determined a series of strategies to improve the effectiveness of obesity management and prevention services.

For example, the researchers found that raising awareness of healthy weight and the availability of community resources, such as YMCA fitness classes and local recreational activities, was helpful.

Another effective strategy was to encourage collaboration among team members, such as dietitians, physical activity experts, nurses and family physicians.

From the focus group discussions, the researchers found that patients appreciated recommendations for lifestyle changes, rather than just prescriptions for medications.

Brauer hopes the logic model will encourage health-care professionals to think critically about current treatment methods in order to better support patients.

“We want the model to foster a conversation between team members about their services, while providing teams with a standardized checklist to use when treating patients with obesity,” she says.

The logic model emphasizes multiple tactics for managing obesity. These could include combining regular doctor checkups with group support programs to provide patients with a peer network of people experiencing similar transitions.

Brauer says the model’s stress on improving overall patient health rather than focusing solely on weight loss will prevent further development of secondary illnesses such as heart disease and diabetes.

Collaborators on this project include Dawna Royall, a consulting dietitian; Prof. John Dwyer, FRAN; Dr. Michelle Edwards and Heidi Smith, University of Guelph; Tracy Hussy and Nick Kates, Hamilton Family Health Team; and Ross Kirkconnell, Guelph Family Health Team.

Funding was provided by a Knowledge to Action grant from the Canadian Institutes of Health Research.

OBESITY LOGIC MODEL

5 STRATEGIES FOR EFFECTIVE OBESITY PREVENTION AND MANAGEMENT

1 RAISING AWARENESS



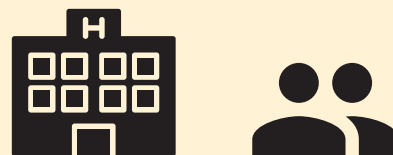
2 IDENTIFYING AND INITIAL MANAGEMENT OF WEIGHT ISSUE



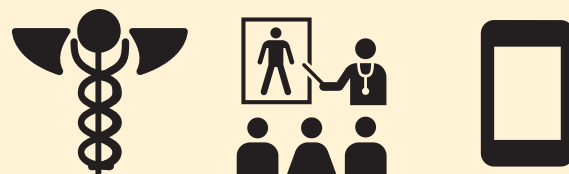
3 FOLLOW-UP MANAGEMENT



4 EXPANDING SERVICES



5 NEW PRACTICE INITIATIVES



Prof. Paula Brauer, Prof. John Dwyer, Dr. Michelle Edwards, Heidi Smith, Tracy Hussy, Dawna Royall, Nick Kates and Ross Kirkconnell.

Sweat testing catches on in the big leagues

| **Brittany King**

Skilled hockey players appear to glide effortlessly up and down the ice, but they're sweating profusely and becoming mildly dehydrated in the process — so much so that sweat testing developed at the University of Guelph is becoming increasingly common in the National Hockey League (NHL).

Sweat testing in hockey, first carried out in 2005 by Prof. Lawrence Spriet, chair of Human Health and Nutritional Sciences, yields recommendations for how much water, salt and carbohydrate (fuel) each player needs to perform, physically and mentally, at their best.

Beyond hockey, the method is widely used among elite athletes, including those in other stop-and-go sports and endurance events.

"We are really excited about this testing because it's the first of its kind in the world and we are leading it here in Canada," said Spriet.

Sweat testing is non-invasive. Body weight, fluid and food intake are measured before and during competition. A second body weight measurement taken after competition determines how much mass is lost through sweat.

Sweat testing has been used in American football and other outdoor sports under warm conditions. It was not considered important for hockey.

But Spriet has shown that athletes on ice should be concerned, too.

Performance worsens when players lose about 1½ to two per cent of their body mass in the form of sweat. That's about 1½ kilograms for an 85-kg hockey player (one litre of sweat weighs about a kilogram), and a common ratio among elite hockey players.

In 2006, Spriet and his research team found that members of the Canadian junior hockey team lost on average almost two litres of fluid during an intense 60-minute practice.

Working with the Detroit Red Wings before the current NHL season, he and his graduate students found that players lost more than two litres of sweat in a 60–70-minute intense practice. As with other pro teams he has worked with, such as the Stanley Cup-winning Pittsburgh Penguins last year, Spriet says, these athletes need to pay extra attention to hydration.

"We are simply trying to put the players in a situation where they can be the best they can be," he says.

Players also lose up to one teaspoon of salt per litre of sweat. Sports drinks contain salt to replace that loss and to minimize replenishment after a gruelling game or practice.

Elite hockey players also use lots of energy, mainly as carbohydrate (glycogen). Carbohydrates provide fuel for contracting muscles and for the brain. Research shows they also activate sensors in the mouth to delay fatigue.

Replenishing carbohydrates in the muscles and liver after a hard practice or game may take a full 24 hours. However, players often have less turnaround time than that. "All nutritional decisions in those hours will directly relate to their next game's performance," Spriet says.

Spriet chairs the Gatorade Sports Science Institute Expert Panel, which has supported some of his graduate students. He is also funded by the Natural Sciences and Engineering Research Council.



Improving recovery and health outcomes

New performance-enhancing tool has a wide range of applications

| Julia Mirota

A new tool designed to enhance performance in athletes at the University of Guelph could pave the way for improved recovery and health outcomes well beyond campus.

Prof. Jamie Burr, Department of Human Health and Nutritional Sciences, is testing how athletes' performance and recovery can be improved through external blood flow manipulation.

This process involves reducing blood flow to a muscle by applying a constrictive device that resembles a blood pressure cuff or tourniquet.

Constricting blood flow causes pooling in blood vessels below the location of the cuff. Previous research has shown that this action alone prevents loss in muscle strength and size. Burr is using this device to test external blood flow manipulation in Guelph's track athletes and other recreationally fit individuals, as well as elderly people and those who are infirm and unable to exercise.

"Our early work suggests that through targeted training, we are able to alter the body's adaptive response, bringing about changes in strength and muscle growth that might not otherwise be

expected with relatively light intensity exercise," he says.

Burr says manipulating blood flow and applying electrical impulses to make a muscle contract can achieve some of the health benefits brought about by exercise.

By combining blood flow restriction with forced muscular contractions, users might gain more muscle strength and size than through more traditional resistance exercise.

He believes this research will lead to improved rehabilitation for bedridden patients, reducing their recovery times and improving their quality of life without having to leave their bedside. Simply applying the device to a muscle group could yield exercise-induced benefits, without the associated risk of falling.

External blood flow manipulation may also help in treating other chronic diseases such as diabetes, says Burr, citing evidence that altering muscle and exercise-mediated hormones could help to regulate blood sugar levels.

"This could have a big impact for people at risk for diabetes or diabetes-related complications," he says.

Others involved are graduate students Joshua Slysz and Kyle Thompson.

Funding for this research is provided by Mitacs, the Natural Sciences and Engineering Research Council, SpringBoard Atlantic, Innovation PEI, and technology development offices at the University of Prince Edward Island and the University of Guelph.

A MATTER OF FACTS



Your body's circulatory system has blood vessels that flow throughout channels all around the body.



With a cuff, the pressure constricts the normal blood flow, so that blood vessels end up pooling together below the cuff. This kind of pressure does not completely restrict blood flow, but makes the system work harder.



Alongside electrical impulses to force muscular contractions, this tool could increase muscle strength and size comparable to gains achieved through more traditional resistance exercises.



This could pave the way to improved rehabilitation for bedridden patients as well as people who have chronic diseases.

Inspired . . . and inspiring

Playwright gives voice to communities rarely seen and seldom heard

| Anna Wassermann

The stories of marginalized individuals, such as persons with disabilities, are significantly under- and misrepresented onstage. But one of Canada's most respected playwrights is determined to shed light on their experiences through theatre.

Prof. Judith Thompson, School of English and Theatre Studies (SETS) and artistic director of RARE Theatre, writes real-life stories of her cast members and uses theatrical elements such as choreographed movement and music to illuminate their experiences in a compelling way.

"I've tried to instill in my students an understanding of the value of their own stories and how these real and ordinary stories are worth hearing and telling," says Thompson.

Throughout her career, she has produced dozens of plays. But one of her first encounters with non-actors telling their real stories onstage came in 2008 when she was commissioned by Dove to develop a piece about beauty and aging.

Thompson was inspired by *The Farm Show*, a seminal Canadian work based on true stories of the farming community of Clinton, Ont. Her production, titled *Body and Soul*, featured 12 women over the age of 45 who disclosed to the audience their personal life stories. The show went on to be performed at the 2010 Vancouver Olympics.

Inspired by these women and the power of real stories, Thompson created *The Grace Project: Sick!*, whose cast members aged 14 to 25 years old reflected on their experiences with chronic illnesses.

Krystal Nausbaum was one of the standout performers of *The Grace Project*, and enjoyed the show so much that she met with Thompson regularly afterward to discuss writing. Inspired by Nausbaum's ambition, Thompson composed a piece for the Fringe Festival—Toronto's largest theatre and performance festival—with nine individuals who, like Nausbaum, have Down syndrome.

The play, titled *Rare*, was voted best piece at the Fringe Festival. Thompson was then invited to stage the work at Soulpepper Theatre Company, Canada's largest urban theatre, based in Toronto.

Thompson's second Soulpepper show, *Borne*, shared the stories of nine wheelchair users. The performers were people with paraplegia or quadriplegia. Thompson says the process of crafting their stories was an eye-opening experience for everyone involved.

"I thought I was fairly knowledgeable about issues of accessibility, but I soon realized that I knew next to nothing—my cast were my teachers, and I learned that we can't be bystanders anymore," says Thompson. "We need to wake up, and these people woke me up."

Thompson's latest work, *Wildfire*, which will open this spring at Soulpepper, explores the boundaries of love for people with visible differences, such as Down syndrome, and the ways in which they struggle with societal judgment.

"The world needs to hear these stories," she says. "We've been successful at reaching a large audience, and working on this piece has also inspired the performers, many of whom have become activists for change."

Borne, the second Judith Thompson play to be staged at Soulpepper Theatre Company, explores the stories of wheelchair users.

Support for this research is provided by the Ontario Trillium Foundation Grow Grant.

Thompson is working with Nick Hutcheson and Brett Haynes, president and general manager, respectively, of RARE Theatre. Thompson also works with SETS professors Gregor Campbell and Mark Lipton, musician Victoria Carr and Soulpepper Theatre Company.

Thompson's shows are developed through her RARE Theatre Company, founded in 2012.

Developing your identity through your journal

| Owen Roberts

Writing down song lyrics in my journal is like a permanent stamp of what happened in that moment and what I did. Or a better explanation of what I was feeling. Even though the song ended in years past, the fact that I wrote those lyrics down on that page at that time is a way to remember. When I go back and look through my journals and I see song lyrics, I see Taylor Swift and I'm like, yea, I remember this day, sitting down I was listening to the song and it just really spoke to me and I wrote down the lyrics... not even like writing out a full song, just different parts that I felt really connected to the situation I was going through.

— Woman, 20

Like that post-teen from one of Prof. Andrea Breen's research projects on self-identity, members of every generation hold dear their own equivalents of Taylor Swift. The words and music of Kurt Cobain, Bob Marley, Bob Dylan and John Lennon immediately come to mind — poets and musicians whose creative works resonate mightily with individuals forming their own sense of identity.

Breen says identities are formed when people integrate their life experiences into an internalized, evolving story of themselves. That evolution is informed by the stories that other people tell, and it can also be informed and reflected by song lyrics, by passages in books — even by traits, admirable or otherwise, of fictional characters and by statements or slogans from leaders.

For example, what were the life circumstances for the research participant that made a particular Taylor Swift lyric speak to her? How was her identity being shaped,

and how was her life story unfolding?

Identities provide a sense of unity and purpose in life. They describe who we are, through the stories we tell of our past. Stories also reveal where gaps, conflicts and other problems exist in our lives, and give researchers clues about areas that need to be addressed for better mental and physical health.

But how do identities get constructed when some people feel unsafe to tell their stories? That's Breen's current concern. The researcher in the Department of Family Relations and Applied Nutrition and her graduate students are studying media influence on Muslim and black young adults' developing identities. She has also worked in northern communities with indigenous people who have resisted the stifling of their stories. Now, she's seeing a new generation whose identity is being challenged by significant change.

"What kinds of stories will help the youth of today navigate the world?" she asks. "In indigenous cultures, stories often centre on connections to the land... but what happens if the land is changing because of climate change? How do environmental crises impact the development of healthy identities?"

And then there's the media. Breen says stories shared by the media can contribute to a sense of collective identity, critical consciousness and an overarching life philosophy. In their research, she and her colleagues have seen a connection between participants' descriptions of personally salient media stories and reported life themes.



Time won't fly, it's like I'm paralyzed by it, I'd like to be my old self again, but I'm still trying to find it.

So don't you worry your pretty little mind, people throw rocks at things that shine.

This is the golden age of something good and right and real.

Taylor Swift performing in London, England, 2012, and some of her lyrics.

Wondering why we bother with love if it never lasts.

Breen is surveying students on campus to better understand evolving challenges to the development of their identity. She points to factors such as divisive politics, extreme conservatism and even fake news as changes in society influencing the kinds of stories available to inform young people's identities. Demographic changes also create new challenges for developing identity.

For example, Breen notes that many students are actually providing care for family members with illnesses or disabilities at the same time they are enrolled in their studies at university. She is leading an undergraduate research project to help these students tell their stories through photography.

"Telling stories really helps us understand ourselves and others," she says.

Breen's research is sponsored by the Lupina Foundation through the Challenge Research Fund provided by the dean of the College of Social and Applied Human Sciences. Her work on media stories has been funded through an Insight Development Grant from the Social Sciences and Humanities Research Council.



Student employees at one of U of G's quick service restaurants must rely on psychological capital to stay calm during busy shifts at work.

Psychological capital

The key to individual and collective success

| Amber Hutchinson

Incorporating psychological capital—that is, optimism, hope, confidence and resilience—in the workplace is essential for employee health and productivity, says Prof. Jamie Gruman from the Department of Management at the University of Guelph.

“Independently, these four characteristics promote positive outcomes,” he says. “Together, they provide the key to thriving individually and as an organization.”

As co-founder of the Canadian Positive Psychology Association, Gruman studies applying and developing positive psychology in order to promote healthy and thriving workplaces. He does this by concentrating on the approach that companies take to incorporate their new staff.

At Guelph, Gruman involved his third-year managerial skills class in psychological capital research by presenting his students with “real life” situations.

Their assignment was to organize an event or produce a product to sell, such as a charity dinner or a calendar. Students each completed a survey at the beginning and end of the assignment containing questions to determine their level of psychological capital.

Gruman says before starting the project, psychological capital of the students was high. That demonstrated confidence in their ability to handle the task.

However, most psychological capital dropped over the course of the project. He says this might have been due to the new, unexpected challenges they had to face, such as negotiating a deal for the first time or booking a venue.

They can encounter similar situations entering the workforce or starting a new job—both can seem overwhelming, and lead to confusion and anxiety.

If this stress is prolonged, it can have a significant impact on physical and mental health.

Gruman says low psychological capital is particularly common in new employees, such as university graduates entering the workforce. If they’re not trained properly, their health may be at risk. The workplace must properly support and integrate new employees, provide them with the tools they need to succeed and avoid the detrimental effects of stress.

“Proper socialization to a new position gives the employee a clear understanding of their role, giving them confidence in the work they are doing,” says Gruman. “This confidence allows them to set goals and generate resilience through challenges, which can help improve health and performance.”

Depression, malnutrition have researchers seeing green

| Owen Roberts

Researchers know that greenery such as flowers, plants and trees can help brighten moods and fight depression... but can it also help improve people's appetites?

Karen Shlemkevich, a graduate student in the University of Guelph's School of Environmental Design and Rural Development, and her adviser, Prof. Nathan Perkins, are taking steps to find out. They're involved in an onsite research project to see whether nature can improve the eating habits and dining experience of residents in long-term care facilities.

Their research locale is St. Gabriel's Villa, a 140-resident facility in Chelmsford, Ont., near Sudbury. Some residents there experience problems with depression and poor nutrition, as do residents in similar facilities.

Depression results from changes in body chemistry, as well as isolation, medication, and loss of friends and family, among other things. When depression occurs, appetite inevitably falls off. And when residents don't eat, they end up malnourished, despite the best efforts of staff.

The atmosphere in dining halls compounds the problem. Residents see dining facilities as busier, noisier and less welcoming than their own homes. Residents may eat faster and poorly, just to get back to their rooms.

Or they may shun the dining hall and miss important social interactions that come with dining together.

Shlemkevich has seen these situations up close. Before entering graduate school for landscape architecture, she worked for 10 years as a long-term care staff member, including two years at St. Gabriel's as a life enrichment assistant. There, she



Prof. Nathan Perkins (below, left) and Karen Shlemkevich are optimistic about the greenery project's potential for improving the lives of residents in long-term care facilities.



developed and ran activities for residents to encourage social interaction, physical activity and cognitive stimulation, including a horticulture therapy program that involved residents in planting and maintaining greenery.

For his part, Perkins is a renowned landscape architect. He's worked on outdoor landscape design projects with several well-known long-term care facilities domestically and internationally, to promote a more welcoming and positive experience for residents. As well, he's helped create calming indoor environments in psychiatric hospitals on three continents, and in places such as casinos, to counter overstimulation.

Together, Perkins and Shlemkevich created a research program that uses their joint expertise.

Since last fall, Shlemkevich has raised nearly 100 plants — ivy, coleus and spiderwort — in a makeshift greenhouse and spare bedroom at home in Sudbury.

On Super Bowl Sunday, after dinner when residents returned to their rooms, she hauled the plants into one of St. Gabriel's three dining halls, and incorporated them into what's called a green wall.

This particular model is a free-standing, two-part structure on casters, about eight feet wide and 5 ½ feet tall. The plants are held in pockets, where they can be watered and tended. The wall is a central and signature feature in the dining hall.

For six weeks, Shlemkevich worked with St. Gabriel's staff to monitor the food intake of 34 residents who normally eat in this particular hall. She's collected two meals' worth of data for two weeks; now, she's comparing consumption over that period to the two weeks before the green wall was introduced, and for two weeks after it will be removed.

She and Perkins are optimistic about the greenery project's potential for improving residents' lives.

"Nursing home residents typically don't eat enough," says Shlemkevich. "We hope this helps."



Coffee drinkers: You'll be bitter about climate change

Plant disease in Central America may lead coffee producers to harder but less pleasing varieties

| Amber Hutchinson

Coffee leaf rust is a fungus that has destroyed coffee crops worldwide since the late nineteenth century. From 2012 to 2014 alone, the rust caused Central American farmers to lose \$616 million in revenue. Prof. Stuart McCook, Department of History at the University of Guelph, has long studied the disease.

His findings have helped the coffee industry cope with the disease. "Eradicating coffee rust is virtually impossible," he says. "But just like any other disease, it's manageable."

Or at least, it was.

Lately, McCook has become concerned about rainfall and minimum temperatures that are inching upward in coffee-producing countries such as Guatemala, Honduras and El Salvador. He's now trying to grasp the role climate change plays in fast-tracking the fungus, and making it more difficult to manage.

Farmers have adjusted their production practices to deal with the disease, which inhibits photosynthesis in plant leaves. The fungus that causes coffee leaf rust thrives in dense and damp environments, making Central American coffee plantations an ideal location for it to germinate and diffuse.

As a solution, producers began growing coffee at higher altitudes where conditions are dryer and cooler. But as the climate has changed, that's no longer a safe refuge.

This change is hitting rich and flavourful Arabica coffee species the hardest. McCook says high susceptibility to coffee leaf rust and sensitivity to climate change has created Arabica "graveyards" and devastated local economies and communities that rely on coffee production.

McCook predicts climate change will force some producers to grow Robusta varieties that resist rust and can better withstand the changing weather conditions. However, coffee from these plants does poorly on the market, due to its more bitter taste.

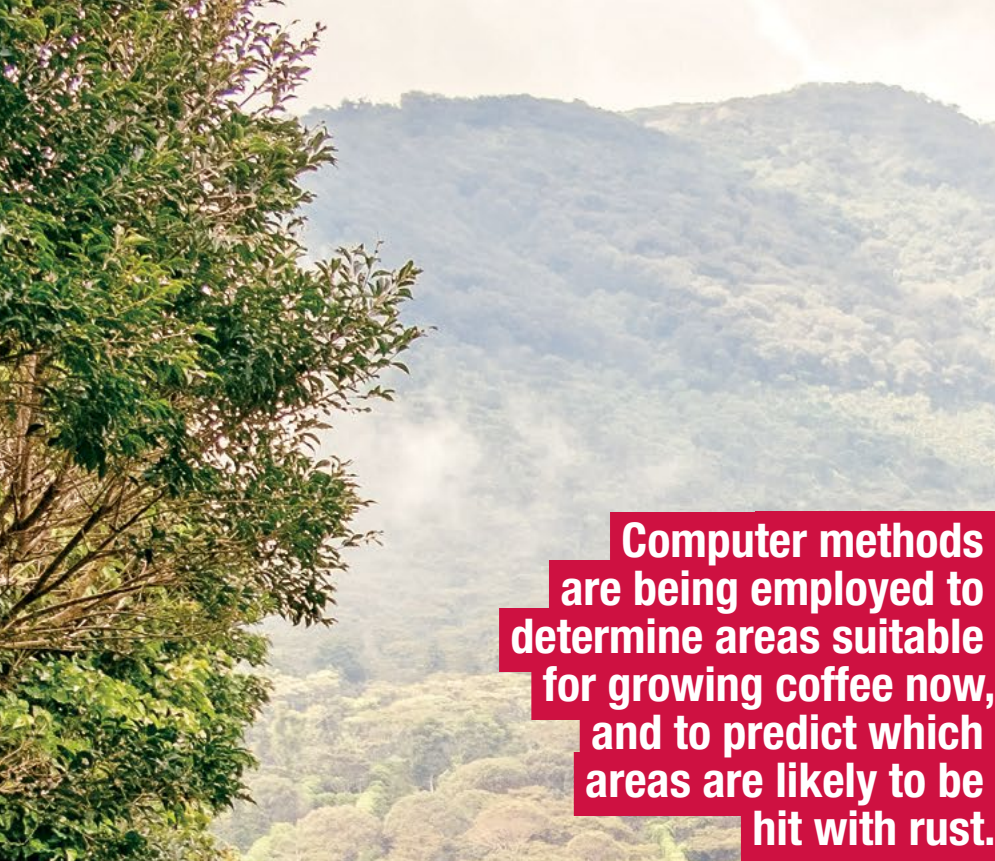
Instead, McCook hopes advanced management practices, such as predictive computing, will help. Such computer methods determine areas suitable for growing coffee now, and predict which areas are likely to be hit with rust.

As well, he's looking to plant breeders to develop new Arabica varieties that are more resistant to rust and can also adapt to heat stress.

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



Coffee farms, like this one in El Salvador, depend on healthy plants to support local economies and communities.



Computer methods are being employed to determine areas suitable for growing coffee now, and to predict which areas are likely to be hit with rust.





Celia Kennedy, immersed in fieldwork on the Eramosa River, holds some of the monitoring equipment used to collect data from the river and the underlying groundwater.

New tools offer insight on local water supply

| Elisabeth Aerts

Monitoring and maintaining clean drinking water for any municipality requires a significant level of expertise—and in Guelph, the University is pitching in to help.

Colby Steelman, a research scientist with the School of Engineering, has spent the last five years working with engineering professor Beth Parker and with Celia Kennedy and Donovan Capes — both graduate students in the School of Environmental Sciences — to help ensure water quality in the Eramosa River.

“Our field-based research utilizes multiple lines of evidence, obtained from hydrological to geophysical measurements, to create a model comparing water levels, temperatures and electro-conductivity — water’s ability to conduct a current — over time,” says Steelman.

The team has created devices to collect data from the river and the underlying groundwater. They are also studying the bedrock aquifer, or permeable rock that water moves through.

A seepage meter measures the amount of water entering or exiting a river along its base, and can be used to monitor changes in water temperature and chemistry over time.

The researchers also drill small-diameter boreholes to study the groundwater beneath the river to better understand its relationship to surface water. Boreholes determine the physical properties of the aquifer and water, and enable researchers to look for possible contaminants.

“We have observed significant seasonal variability in the hydrological and geophysical behaviour of this river over the years,” Steelman says. “This information will be important to long-term monitoring

of the region’s water supply, all of which derives from the fractured Silurian bedrock beneath our feet.”

Steelman expects that data collected by these devices will influence policy for maintaining a healthy water system.

This research also provides necessary information about the river’s aquitard, the protective barrier for the aquifer that prevents contaminants from reaching the city’s water supply. Along with calculating and compiling information about the river’s current and past condition, this model may be used to predict future water quality.

This research is supported by Scouts Canada, the Natural Sciences and Engineering Research Council (NSERC), the NSERC Banting Fellowship, an Ontario Research Fund Research Excellence grant, and the Grand River Conservation Authority.

A chemical cocktail no one ordered

Fish have been hammered by human medications that end up in the water supply

| **Alaina Osborne**

Drugs such as birth control medication, ibuprofen and anti-anxiety medications have their place... but when they're excreted in urine and passed into the water supply, at some point they begin to affect wildlife. Fish living in these waters have experienced changes in growth, development and reproduction, and researchers are anxious about the implications.

"There have been delays in sexual maturity, and in some cases, the loss of species in certain regions," says Prof. Glen Van Der Kraak, Department of Integrative Biology.

That's why Van Der Kraak and his lab are looking at the effects of pharmaceutical waste and how better waste-water management may prevent further environmental harm. The researchers are focusing on fish populations living downstream

from sewage treatment plants, from which high concentrations of chemical waste are discharged.

Fish here are especially at risk for physiological changes, such as hermaphroditism. It causes male fish to develop eggs in their testes, which could render them infertile.

Interpreting the changes seen in wild fish is difficult; researchers can't pinpoint exactly when changes may have occurred in the fish or the chemicals causing these changes. Also, because fish move around, it can be challenging to judge whether certain fish come from a specific area or have just migrated there.

More controlled experiments may be conducted in the lab. Here researchers study the effects of pharmaceuticals and other potentially toxic chemical contaminants such as ammonia and nitrates found in our waterways.

Van Der Kraak and his research team have studied the effects of runoff from pig farms, pulp and paper mills and the Alberta oil sands. In Alberta, they found that oil extraction affected smaller fish in the lab and the field.

Provincial legislation forbids the release of oil sands effluent into the environment. Meanwhile, vast quantities of waste water are stored in artificial lakes whose long-term fate remains uncertain.

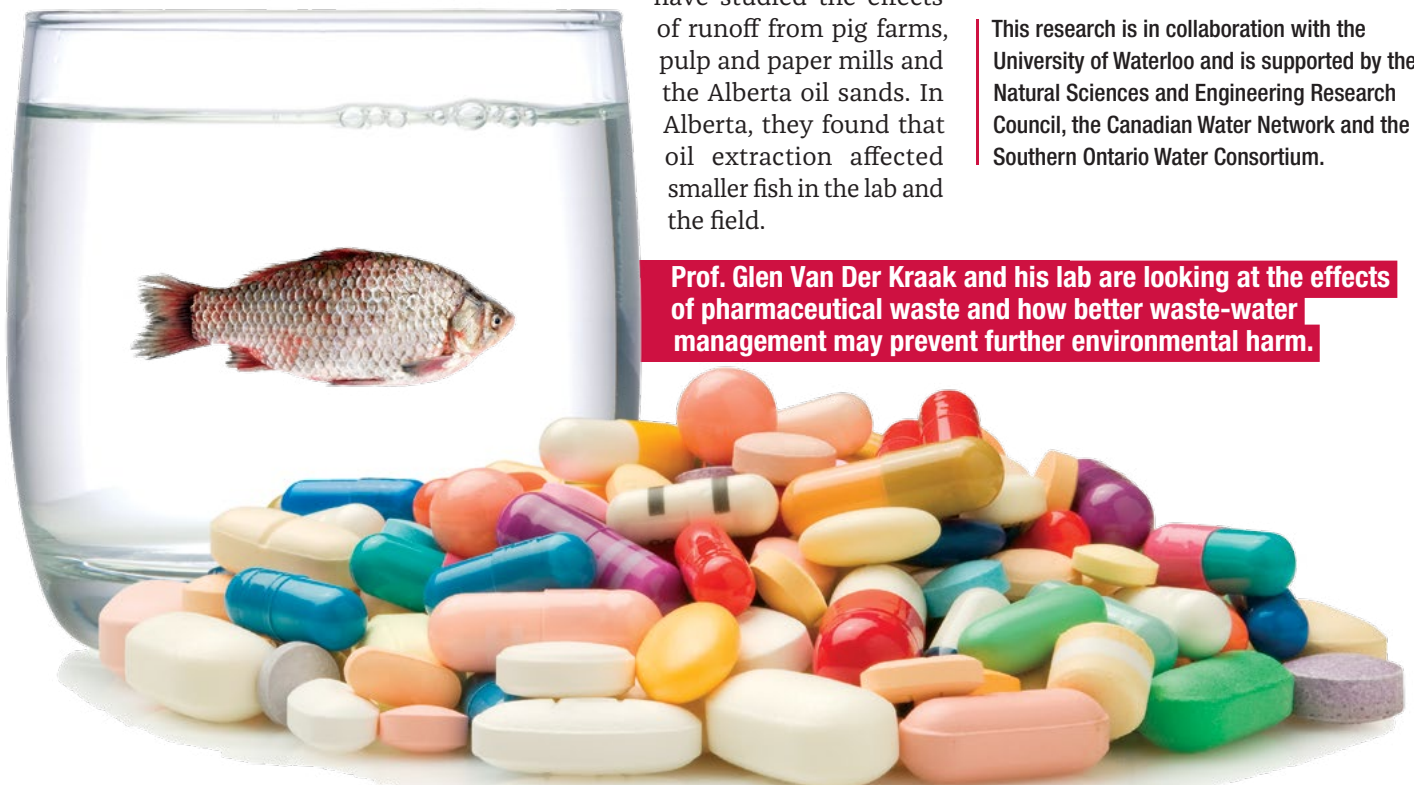
Van Der Kraak says we need improved effluent treatments to reduce the impacts of anthropogenic chemicals entering our water. He's working with engineers on recommendations for treatment technologies.

He's optimistic about their progress.

"This kind of research builds on a multitude of strengths that exist in different disciplines to try and tackle big environmental issues," he says. "It's important for people to realize that there are teams of researchers that are asking questions about the quality of our environment. We all want to live in southern Ontario, so we must make sure we do it in such a way that will leave something for the next generation."

This research is in collaboration with the University of Waterloo and is supported by the Natural Sciences and Engineering Research Council, the Canadian Water Network and the Southern Ontario Water Consortium.

Prof. Glen Van Der Kraak and his lab are looking at the effects of pharmaceutical waste and how better waste-water management may prevent further environmental harm.





Cow brushes, installed at the Elora Dairy Facility, offer a form of voluntary enrichment and improved welfare for cattle. Cows' natural behaviour is to rub against trees; in a barn, they can rub safely against a brush.

Here's the evidence

Centre promotes research-based animal welfare policies

**Joanne Pearce
and Owen Roberts**

Evidence-based decisions are key to good policy-making. In Canada, when it comes to animal welfare, evidence-gathering has been the domain of the Campbell Centre for the Study of Animal Welfare at the University of Guelph for more than 25 years.

The centre operates under the guidance of executive director Prof. Tina Widowski, Department of Animal Biosciences. It involves nine specialized faculty, other associated graduate faculty and more than 50 graduate students, three-quarters of whom are focused on food animals. The group brings academic excellence and real-world experience to the quest. Some of our graduate students are practising veterinarians or people from various animal industries who want to receive formal skills and training in animal welfare science.

"A vast majority of our research involves the impact on health or some measurement of animal well-being," says Widowski. "The study of welfare is inextricably linked across all species, drawing from a wide range of approaches and perspectives."

Farmers realize research is fundamental to the well-being of their operations. They know research and science help keep animals and plants healthy. Governments, along with the agricultural sector, invest sizable funds into research at institutions such as the University of Guelph, to ensure policy-makers have the science-based evidence to make decisions.

Over time, citizens have demanded more say in the way food is produced. That's leading to some huge changes in animal welfare, in several areas.

One is housing and the drive toward cage-free, open production. As well, researchers are looking hard at livestock transportation, particularly from western Canadian feedlots to Ontario and Quebec processing facilities, and the challenges livestock face during that journey (see sidebar story). They're also trying to create best management practices for procedures such as castration, dehorning and euthanasia, to make them as humane and safe as possible.

Widowski predicts that society's welfare expectations will increase.

"We'll need to improve welfare, yet at the same time be environmentally and economically sustainable," she says.

Feed before water or rest — that's the priority for cattle shipped on long hauls

Being transported is one of the most stressful experiences for livestock.

Federal regulations require that cattle being transported for more than 52 hours be unloaded to rest for at least five hours within the first 48 hours of travel.

Once they are unloaded, they are free to eat, drink, or lie down and rest.

Prof. Derek Haley, Department of Population Medicine, has found that most animals go directly to feeding, ignoring water and rest even after they have been standing on the transport truck for more than 24 hours.

"More proceed to eating first, which tells us that they are feeling more hungry than thirsty when they first arrive," he says.

"Discovering what their behavioural priorities are is important to help us gauge how they are coping with their long journey," says Haley. "That can help us tailor the rest station environment to best meet their needs, which should improve their welfare and help them do better when they arrive at their destination."

His research team found rest station stops lasted much longer than the five-hour legislated minimum. That should be good for the animals, he says. But he suggests further research be conducted to help provide the best possible rest station experience for cattle.

He says little research has been done on cattle management during rest stops.

— Joanne Pearce

This research is funded by the Ontario Ministry of Food, Agriculture and Rural Affairs.

Prof. Alison Duncan, HHNS



Where I'm going with my research

Let's make healthy food choices

When it comes to my research, some people wonder what's in it for them. But they don't have to ponder that question for very long. What's in it for them is better health.

People aren't eating very well these days. The Canadian Community Health Survey reports that Canadians' food choices do not make for a balanced diet. It also says one in four Canadians eats their meals at fast food restaurants. There is room for improvement.

That's where I come in, along with the students in my lab and my collaborators.

Food can't fix everything — better health is a combination of diet and other lifestyle habits such as physical activity. But food choices certainly have a lot to do with the health status we can expect.

I focus on how agriculture connects to food and health, something I like to call the agri-food-health continuum. Specifically, I'm interested in the application of agricultural products with bioactives to human diets in order to assess health benefits. Bioactives are

the parts of foods (nutrients, phytochemicals) that can have biological effects in our bodies.

Bioactives could be dietary fibre. Or they could be isoflavones, a phytochemical found in high amounts in soybeans.

I'm pursuing human studies to learn how bioactive components of food prevent disease (diabetes, heart disease) and promote health.

I pay particular attention to healthy aging, given the older Canadian demographic and the

importance of food and nutrition for a healthy, long life.

Earlier this year, that interest led me and my graduate students to create the *Recipe Resource for Healthy Aging*, a dietary strategy to help people reduce their risk of chronic disease.

Many of the foods that we eat every day are grown right here in Ontario. They're nutrient-rich, they provide us with essential nutrition and they offer benefits that support healthy aging.

What drives me to pursue this research? Well, I love nutrition, not to mention the amazing people I get to work with. I also love that what we eat can affect our health. These are our choices to make, and I love figuring out what the best choices can be.

My goal is to use the scientific process to create evidence-based dietary strategies that help all of us live a longer, healthier life.



Many of the foods that we eat every day are grown right here in Ontario. They're nutrient-rich, they provide us with essential nutrition and they offer benefits that support healthy aging.





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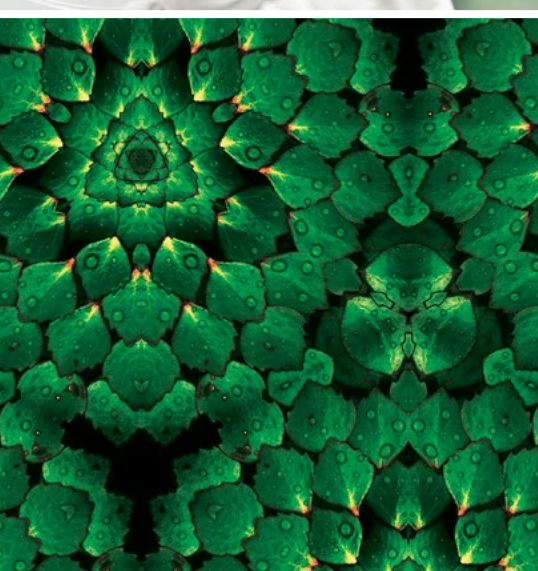


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