

Human Health and Disease

Striving for a healthier world

The University's *one health* focus promotes an understanding of the relationship between human, environmental and animal health. Guelph researchers strive to understand and provide cures for the whole health spectrum, from zoonotic diseases to mental health issues.

Our researchers have received special recognition by Canadian health funding agencies for their work on cancer, as teams across departments and colleges work together to understand every stage of this common disease, with the goal of one day having a cancer-free world. Health research at the University of Guelph also considers the ever-important social and economic implications of health.

As Canadians' diets have become a significant source of disease, such as obesity and diabetes, University of Guelph researchers are looking for ways to fight diet-catalyzed epidemics by borrowing traditional knowledge and dietary advice from cultures halfway around the world. Combining ancient medicinal practices with modern lab techniques means researchers can help ensure food is a source of sustenance and health.

Guelph researchers from many disciplines are working together to find solutions to a vast variety of health issues, and to develop effective preventative measures. The following pages highlight the University of Guelph's commitment to improving human health and preventing disease.



RESEARCH HIGHLIGHT

Three-dimensional cell cultures accurately mimic mammary tissue. Prof. Alicia Vilorio-Petit and graduate student Geordon Avery-Cooper use fluorescent stain and a confocal microscope to visualize them.

Research

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- What if you could get some of your daily fibre intake from your favourite dessert? Food science researchers are working to **enrich three dairy products** — a milk shake, pudding and ice cream — to help meet Canadians' fibre needs. The products could also lower blood glucose levels, making them ideal for diabetic individuals.
- Physics and molecular and cellular biology researchers are studying a **mysterious protein implicated in the formation of multiple sclerosis** (MS). Called myelin basic protein, it's responsible for coating the outside of neurons and increasing the speed of nerve impulses. Its degeneration results in the neurologically based co-ordination problems associated with MS. Researchers are studying the structure of this protein to gain insight into how and why it degenerates.
- Food science researchers are developing a new sensor device for fast and **accurate detection of pathogens and toxins** in food sources. About 10 centimetres in diameter, the portable, hand-held prototype was designed to detect the common pathogen *salmonella*, and researchers hope to adapt the sensor to test for other contaminants in the future.



- A team from the University of Guelph's Kemptville campus is working in partnership with Health Canada scientists to learn how to **identify and monitor contaminated foods**. The study's main purpose is to shed light on contaminants the average Canadian (from infant to senior) consumes in their diet. Popular food items are purchased, catalogued and prepared as they would normally be in the household. Then, composite samples are bottled and analyzed for contaminants to help researchers identify the potential sources of contamination and to help develop guidelines for safer food preparation.

breast cancer soy BPA MS
 detection of pathogens safer
 mass-produced medicinal pla
 vaccines replacing antibiotics
 more effective chemo suppo

- A cell culture system designed to mimic a minute part of a mammary gland is helping researchers discover **how breast cancer cells move throughout the body** and survive to form tumours in distant sites. The unique three-dimensional system allows researchers to identify which cell signalling pathways are involved in this process, called metastasis, and could eventually lead to treatments designed to target and block these tumours from forming.
- BPA, the now-infamous ingredient in plastic water bottles, can cause cognitive impairments at doses much lower than the current "safe-level" guideline indicates. The chemical interferes with neural plasticity, the brain's ability to alter its structure and function throughout adult life. This means long-term **BPA exposure could affect our ability to acquire, analyze and store new information** and even contribute to mood disorders such as depression.



RESEARCH HIGHLIGHT

Many intestinal pathogens have developed protective sugar coatings to avoid detection by our immune system. Prof. Mario Monteiro, pictured here, is developing vaccines against them.



RESEARCH HIGHLIGHT

The Guelph Food Technology Centre's sensory lab allows Prof. Lisa Duizer (left) to improve tastes and textures. Duizer, along with students Matt Rietberg (right) and Derek Vella, run sensory trials in the lab, where panellists in individual booths evaluate various products and processes.

toxins Omega-3-fortified foods enriched dairy
 food obesity and sleeping evidence-based medicine
 nts lower sodium, same taste safer kids with pets
 s improving hearing aids robots for physio
 rt for depressed teens cleaner food production

- Chemistry researchers are looking to create **sugar-based vaccines** for two common types of intestinal bacteria that cause diarrhea, *Campylobacter jejuni* and *Clostridium difficile*. Creating these two sugar-vaccines is important because they address growing concern about overusing expensive antibiotics. The vaccines could help people who are most vulnerable to the bacteria, such as travellers, hospital patients and those in developing countries without clean drinking water, to avoid serious illness or even death.
- Many of the **most dangerous bacteria use specialized toxins** to enter and destroy cells as they infect their host. How these toxins work remains a mystery. That's why researchers are using X-ray crystallography to capture the toxins' three-dimensional structure, which can provide clues to how they function and what molecules could be used to inactivate them.
- Robots are most commonly used for industrial purposes, but University of Guelph engineers are now using them to **assist stroke patients** in rebuilding muscle memory and strength. They're developing robots that patients can use at home to speed up the recovery process. These robots will also enhance physiotherapists' work and decrease their often physically strenuous workload.
- With an aging population and an increase in hearing problems, hearing aids are an imperative technology that could be improved. Engineers are working to make **hearing aids more selective in the sounds they amplify** to help listeners focus on specific sounds, rather than *all* sounds such as background noise. By combining computer chip technology and computational intelligence, hearing aids will be able to automatically adjust settings to new sound environments.
- Obesity and sleeping problems have separately been central to a great deal of research, but a possible relationship between the two issues has, until recently, been unexplored. Participants in a community health program centred on improved diet and exercise habits completed surveys to identify sleep patterns. The analysis showed that more than 80 per cent had sleep problems, but only one-third of "poor sleepers" had been treated by a health professional. Researchers say new **studies targeting improved sleep**, in addition to improved eating habits and physical activity, are needed.
- Evidence-based medicine, based on clinical research and general results, is the primary guide for practitioners and policy-makers' decisions in today's health-care system. However, before the 1980s, health-care decisions were based on prior knowledge, past experiences and individual patients. Now, Guelph researchers are working towards **integrating evidence-based medicine** with experiential medicine, to improve patient care.

- Within East Asian cultures, where high soy diets are common, significantly lower breast cancer incidence and mortality rates occur than in Western countries. Researchers developed a transgenic animal model to study mammary tumours, including the possibility that high **soy-based diets could reduce cancer risk in women**. They believe soy protein could cause rapidly developing pubertal mammary glands to behave more similarly to stable, mature mammary glands, where the cells are more developed and less susceptible to tumour formation.

- A Guelph-based research team wants to ensure that older adults living in long-term care facilities are eating well at each meal, through better quality, more nutritional foods. They've been interviewing and observing older adults to track what they're eating and determine what nutrients are missing from their diets. The team includes several food science and human nutrition researchers working with the Department of Family Relations and Applied Nutrition to **develop foods and purees fortified with Omega-3 and protein**, which researchers say could help delay the onset of diseases such as Alzheimers.

- Plant agriculture researchers recognize the positive health benefits enjoyed by Canadians who incorporate **medicinal plants** into their regular diet. To encourage and improve this multi-billion-dollar market, they're using cloning and tissue growth techniques to mass produce plants with the highest possible amounts of medicinal compounds in a safe, greenhouse environment.



RESEARCH HIGHLIGHT

X-ray crystallography allows Prof. Rod Merrill (right) and graduate student Robert Fieldhouse to examine the structure of the harmful toxins they're studying in their lab.

- Those who suffer from depression prior to adulthood are more likely to experience a serious course of illness in their lifetime. Guelph researchers recognize that **better coping mechanisms and support systems** are needed for youth and thus are developing a website that is easily accessible and attractive to teenagers. The online program will assist individuals in learning how to positively cope with stress, recognize their moods and build a positive thought process.
- Bacterial biofilms that form on food processing equipment can contaminate food, causing outbreaks of food poisoning. These biofilms pose a challenge because they're extremely hard to prevent and remove. Researchers at Guelph are part of a national initiative to learn how and why some prevention and removal strategies are successful, while others are not. Currently, they're studying how bacteria respond to different treatments in order to develop an **efficient cleaning process for the food industry**.

- As children explore their environment they may behave incorrectly towards household pets, especially the family dog. These interactions can result in severe injuries, primarily to the child's head and neck regions. In response, Guelph researchers are developing an interactive software program, *Blue Dog*, which **teaches children how to properly interact with pets**.
- The protein P-glycoprotein, has been discovered to be responsible for chemotherapy ineffectiveness, because it actually pumps chemotherapy drugs *out* of tumours. Now researchers are working to understand **how the P-glycoprotein interacts with thousands of chemical compounds**, to determine which chemicals will be effective during cancer treatment.
- Environmental biology researchers are modifying enzymes found in nature to **create enhanced paper filters**. Unlike current filters which rely on small pores to block contaminants, these filters contain special proteins that can actively bind to pathogens, and remove them. Researchers believe they could be used to remove water contaminants, purify disease-causing antigens for medical research, prevent undesirable agents from entering emergency blood supplies and even protect citizens from bioterrorists.



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