

Volume XXI Number 1 Fall 2006 Focus on Public Health

Research

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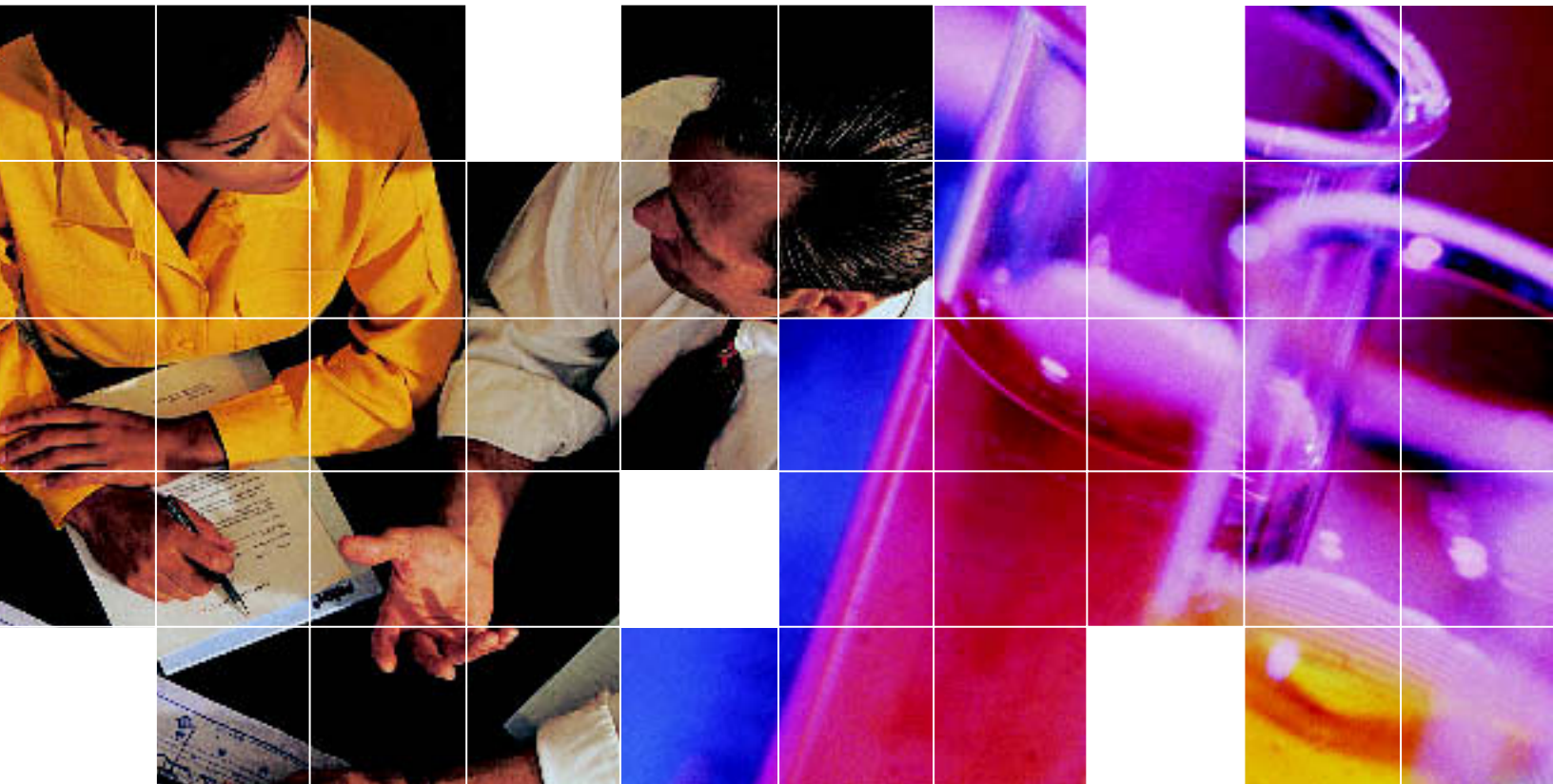


*Outdoor fun
helps keep
kids fit.
See page 5.*

Health and Nature

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Cover photo by Dave Peleschak

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ABOUT RESEARCH ACCOMPLISHMENTS AND ACTIVITY AT THE UNIVERSITY OF GUELPH

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LET'S START HERE

A dual reflection on health and nature

Researchers at the University of Guelph have a lot to say about health and they have a lot to say about nature. And so they should. Health and nature — or well-being and the environment — are heady words. They embrace a broad spectrum of things that matter most to people, such as minimizing the likelihood or impact of adverse health, or doing things that help us understand and take care of the world around us. In so many ways, these words are also intimately linked.



Alan Wildeman

The Roman god Janus had a double-faced head, with each face looking outward in opposite directions. He was noted as being the god of gates and doors, the god of beginnings and endings. He was heralded at important transitions in people's lives when they reflect on the past and look forward, such as harvest time, marriage and birth. He also came to represent the transition between primitive living and civility, between rural and city life, between war and peace, and between youth and age. While each member of these various dualities is distinctive from its partner, they are all different faces of the same existence.

This issue of the University of Guelph's *Research* magazine is a dual reflection on health and nature. From one side, you will read about what Guelph researchers are doing to learn more about the nature of health. From cancer research to studies of infectious diseases and animal health, new discoveries are being made about the mechanisms underlying diseases and new research on how to stay healthy is under way. From the other side, you will read about health and nature. You will find stories about research being done to help us understand the natural world around us, and how the health of that world and our own health are linked.

The format is in the tradition of Janus, because when we use the word health, there are literally at least two sides to every story. This is not two issues of the *Research* magazine merely stapled together. Rather, this issue provides you with two perspectives on health and the world we live in and on research being done at the University of Guelph to help us understand their relationships.

Each of us in our lifetime will deal with transitions in health and nature. At our university, there is a history of doing things that are relevant to the health and well-being of people, communities and the environment. This issue highlights how, in a world with more people than ever before and an environment under greater stress, this tradition is continuing through world-class research that becomes more relevant and needed with each passing year.



Alan Wildeman
Vice-President (Research)

Go wild!

Kids need places outdoors to let loose

By Alicia Roberts



Dave Peleschak

Well-meaning safety concerns — as well as TV and video games — are keeping kids sedate and indoors and may be restricting their appreciation of, familiarity with and enjoyment of nearby natural environments, say University of Guelph landscape architecture researchers.

Prof. Nate Perkins, School of Environmental Design and Rural Development, believes that wild places such as woodlots, creeks and hedgerows develop children's imaginations in ways that virtual simulations never will.

"I understand why parents may be afraid of the risks occurring outside of the home," he says, "but what they don't recognize is that wild places can have health benefits for their children."

Perkins and former graduate student Sarah McCans are examining how wild places can be preserved and better used by urban and suburban children. They're also taking a closer look at

the availability of wild places, how many children use these spaces and ways to increase parents' awareness of the benefits such places can offer.

Perkins also thinks concerns about traditional playground equipment should be put in perspective. He's found that the No. 1 safety hazard at North American schools is actually the asphalt that playgrounds are built on or around. In most cases, however, it's the playground equipment that's being removed, not the asphalt.

Surfaces aside, outdoor play is crucial to a child's physical, psychological and social development, says Perkins. In particular, the outdoors can provide inspiration for more creative thinking. Children from rural and suburban areas, who tend to spend more time outdoors, have more highly developed imaginations, he says.

Wild play areas develop children's imaginations in ways that structured and programmed play areas never can, says a University of Guelph professor.

"Kids know more about rainforest ecology in Brazil than what's going on in their backyards. They have more knowledge, but they don't explore and experience their everyday environments. We hope to help change that."

Also involved in this project was Prof. Barb Morrongiello, Department of Psychology.

This research was funded in part by the Environmental Design Research Association. ■

Canine friends that visit patients through hospital and long-term-care companionship programs may also be a source of disease.



Mary Waddell

A visit from Fido has been shown to benefit some patients in hospitals and long-term-care facilities by offering companionship. But do these soothing canine connections actually do more harm than good? Ontario Veterinary College researchers wonder.

Prof. Scott Weese of the Department of Clinical Studies, along with PhD candidate Sandra Lefebvre and Prof. David Waltner-Toews of the Department of Population Medicine, is looking at whether hospital visitation programs that put dogs in touch with human patients have risks that aren't being addressed.

"Animals that are brought into the facilities can be a source of infection for hospitals, but they can also pick up diseases and spread them to the community outside the hospital," says Weese.

It may be as easy as petting a seemingly healthy dog that is actually carrying an infectious pathogen.

In fall 2004, he and his research team began looking closely at dog visitation programs, including what types of patients are being visited, the form of contact allowed between animals and people, what pathogen types the dogs

carry and what types they pick up over time.

In the study's first phase, 102 dogs in visitation programs across Ontario were tested for pathogens. The results showed the majority of dogs were carrying at least one pathogen that is transmissible to people. In particular, 58 per cent of the dogs tested positive for various strains of *Clostridium difficile*, the most common cause of hospital-acquired diarrhea in people. Other major bacteria that raise the most concern, such as methicillin-resistant *Staphylococcus aureus* (MRSA) and vancomycin-resistant *Enterococcus* (VRE), were



Dogs, germs and hospitals

By Kate Roberts

not detected in the dogs.

MRSA and VRE are significant causes of disease in hospitalized people. MRSA can cause everything from surgical-site infections to pneumonia and bloodstream infections. VRE is most often associated with persistent urinary-tract infections and bloodstream and wound infections.

Lefebvre says MRSA and VRE infections are particularly hard to treat because they're resistant to the common front-line antimicrobials. This means both infections are significant causes of sickness and death in acute-care facilities

and increasingly in long-term-care facilities.

MRSA, VRE and *C. difficile* are now being monitored in dogs during the second phase of the study. Their prevalence is being tracked in 100 dogs before the animals enter care facilities and then throughout their visitations for one year. A control group of another 100 dogs that don't enter hospitals or long-term-care facilities is also being studied to understand the incidence of these pathogens under natural conditions, without exposure to human health-care facilities. Already, the researchers have found instances of MRSA-causing bacteria in

dogs visiting care facilities and are furthering pursuing their prevalence and significance.

Ultimately, Weese and his team will use their research results to work with government and medical associations to create standard evidence-based guidelines to use in animal visitation programs. They hope these guidelines will keep the risk of infectious diseases to a minimum.

This research is supported by the Canadian Institutes of Health Research and OVC's Pet Trust. ■

An unlikely environmental problem for aquatic plants and animals

By Brian Innes

Aspirin and antibiotics — these familiar drugs treat illness and disease in humans and animals, but do they cause environmental problems when they enter ecosystems? No, say researchers in the University of Guelph's Centre for Toxicology. In fact, they say the environmental concentrations of the 25 common drugs they've studied are much lower than the threshold where effects appear.

The concentrations they found were 100 to 1,000 times smaller than those that have caused problems in controlled experiments with aquatic organisms, says Prof. Keith Solomon, who leads the project.

"There is little reason to be concerned with the concentrations of these pharmaceuticals currently found in the environment," he says.

The results are important because, until now, no studies had looked at the environmental effects of pharmaceuticals being used in animal production — and these drugs account for an estimated 40 per cent of all antibiotics produced in North America.

Solomon's team studied individual doses and mixtures of 25 common pharmaceuticals, including antidepressants (selective serotonin re-uptake inhibitors), the cholesterol drug atorvastatin, and antibiotics such as tetracyclines, sulfonamides and fluoroquinolones.

Even though most pharmaceuticals break down relatively quickly in the environment, their continual use and eventual presence in surface water has raised concerns about potential environmental effects.

To shed light on the matter, Solomon and graduate student Linda Lissemore examined concentrations of popular agricultural pharmaceuticals in the Grand River watershed in southern Ontario. The watershed includes both intense agricultural production and urban areas.

Lissemore found that surface water samples had pharmaceutical concentrations in the nanogram-per-litre range. But effects on plants and animals have been observed only at the microgram-per-litre range, a thousand times

higher, she says.

Solomon says interpreting such results from the watershed study requires accurate measures of the concentrations at which drugs affect plants and animals in the environment. They've pioneered what they believe is a more realistic and accurate way to evaluate the effects of pharmaceuticals on complex natural ecosystems than can be achieved through conventional laboratory methods. They've created outdoor microcosms — 1,200-litre ponds complete with algae, plants and insects.

"Our microcosm system has become the benchmark for accurately measuring the environmental effects of pharmaceuticals," says Solomon. "The system allows us to control the substances we want to evaluate while still allowing Mother Nature to be involved."

Located near the main U of G campus, the ponds have been an essential tool for the research team. Graduate student Richard Brain measured the threshold level of drugs for aquatic plants by observing when antibiotics produced a noticeable decline in the green pigmentation of plants. In particular, chloroplasts (the cell components responsible for capturing solar energy and turning plants green) were reduced by the extreme antibiotic concentrations.

This research was sponsored by Agriculture and Agri-Food Canada, the Beef Research Council and the Canadian Network of Toxicology Centres. ■

Kyle Rodriguez

Surface waters contain much lower concentrations of pharmaceutical contaminants than expected, say University of Guelph toxicologists.



Moving their butts around outside

Outdoor smoking areas just aren't suiting smokers' needs

By Alicia Roberts

Designated smoking areas are fine...

as long as you're not a smoker. These areas are typically in remote, isolated locations — purposefully located away from places non-smokers congregate — which deters smokers from using them. Instead, when smokers go outside, they tend to gather near entrances and overhangs, especially in cold weather. Non-smokers end up being exposed to second-hand smoke, and conflict can ensue.

Landscape architecture professor Nate Perkins of the University of Guelph's School of Environmental Design and Rural Development thinks the whole issue needs re-examining and that designers and planners need to find smokers places that are "accessible yet not problematic." He and colleagues at the University of Toronto are finishing a three-year study principally funded by the Canadian Cancer Society to pinpoint causes of misuse of designated smoking areas and make those areas less contentious for all users.

Perkins' colleagues met with focus groups in 2003 to look closely at smoker and non-smoker interactions and the attitudes both groups hold in their shared environments. After many Ontario cities implemented a smoking bylaw requiring smokers to take it outside, smokers and non-smokers alike felt a sense of discrimination, he says.

The focus groups were followed by more than a year of behavioural observations in 12 Toronto locations. The results indicated that smokers are influenced by physical and social factors such as location of seating, sightlines, shelter, types of users and unwritten social norms. Although smokers and non-smokers rarely interacted in smoking areas, most smokers were considerate of others while smoking outside. For example, many smokers would move to locations away from gathering areas.

Perkins believes it's important to understand how social and physical factors influence where and when people smoke, to understand outdoor

smoking areas and develop smoking policies better suited to these environments.

He says design recommendations that come out of this study may increase compliance with non-smoking regulations through the use of visual cues, such as increased use of signs and ashtrays and more clearly defined boundaries.

"Smoking is as much a social activity as it is anything else," says Perkins. "We need to determine the kinds of facilities this behaviour requires, then focus on bringing smokers to

those areas."

He hopes that reducing the conflict between smokers and non-smokers could also influence social norms about smoking, which might result in more attempts to quit smoking and a lower incidence of relapse. ■

Smokers will be more apt to use designated smoking areas that are convenient.



Kyle Rodriguez

Plan to change

Community vulnerability target of U of G researchers studying global climate change

By Clinton Buttar and Rebecca Moore

With an increase in extreme weather events such as floods, hurricanes and droughts, climate change is a growing concern around the world. Researchers at the University of Guelph are taking a lead in evaluating the vulnerability of communities and regions to climate change. They want to provide strategies and measures to help communities adapt, internationally and at home.

Prof. Barry Smit, Canadian Research Chair in Global Environmental Change, has assembled a research team to work with people in vulnerable areas. Bangladesh (salinization and food supply), Samoa (cyclones and drinking water),

Vietnam (flooding, water and sanitation) and East Africa (drinking water, food and sleeping sickness) are some of the regions where Smit and his team are working with community members. He's helping people in these areas identify what they can expect with climate change and establish ways to deal with it.

For Smit, planning is key.

"The ability of people to capitalize on knowing what may happen, rather than pray for weather that isn't coming, will determine who succeeds in the future," he says. "Unusual weather patterns are going to continue and, for some people, they'll get worse."

Climate change is being influenced by the greenhouse effect, an analogy used to describe the process whereby carbon dioxide (CO₂) and other gases trap energy from radiation in the Earth's atmosphere, raising the planet's surface temperature. Because of increased CO₂ emissions from human activities, researchers believe we are now beginning to see the ramifications of the greenhouse effect.

Researchers say that, as the Earth's temperature increases, the warming climate will cause sea levels to rise, change wind and moisture patterns, and intensify many weather extremes.

Climate change effects will likely be felt first



by nations where livelihoods are sensitive to climate and rising sea levels. Nations or groups with less adaptive capacity, such as social supports and resilient infrastructures, will also face problems. The effects could include flooding and loss of homes, reduced and contaminated drinking water, increased disease spread, and famine resulting from extreme weather such as recurring droughts.

On the home front, Canada's Arctic, transportation sector, forestry, fisheries and agriculture are already experiencing losses associated with unusual climatic conditions. Prairie agriculture, for example, has faced unprecedented droughts in recent years.

"Climate change is often thought of as only global warming, referring to long-term changes in average temperature," says Smit. "But climate change is also the frequency and severity of droughts, and these have immediate and serious consequences for producers and for the agri-food sector."

Although the gradual changes in climate may be difficult to identify, sharing information on adaptation strategies to deal with events such as droughts makes sense, he says.

Enter the Canadian Climate Impacts and Adaptation Research Network for Agriculture (C-CIARN Agriculture), which was brought to fruition by Smit and Prof. Ellen Wall of the Faculty of Environmental Sciences. Sponsored by the federal government, the network promotes information exchange while facilitating climate change adaptation research that's geared towards helping Canada's agricultural sector.

"Our primary interest is to ensure that research is practical for the farming community so they have access to new adaptation strategies," says Wall.

She says members of the network are looking at what farmers do now to manage a number of risks, including those associated with climate and weather, so those strategies can be bolstered in preparation for future stresses from climate change.

For example, a study through the Saskatchewan Research Council is documenting how Canadian farmers dealt with the widespread 2001/2002 drought. The project's goal is to determine what farmers did during the drought, how successful their adaptation strate-

gies were, and what tools and resources they needed at the time. Researchers will make the information available to government, producers and other stakeholders to help in developing strategies to deal with the impact of extreme weather on the agricultural community in the future.

"Farming is an inherently risky business," says Wall. "Having to deal with variability and other weather conditions resulting from climate change will only make it more risky. We hope the information presented to producers through the network will help them deal with managing some of that increased uncertainty."

C-CIARN is supported by the Canadian government through the Climate Change Directorate. Smit's research is funded by ArticNet Networks of Centres of Excellence, the Canada Foundation for Innovation, the Canada Research Chairs program, Natural Resources Canada's Climate Change Impacts and Adaptation Program, the Northern Scientific Training Program, the Ontario Ministry of Agriculture, Food and Rural Affairs, and the Social Sciences and Humanities Research Council. ■

Global Environmental Change Group

Isolated northern communities such as Arctic Bay on Baffin Island are getting help from Guelph researchers to forecast what to expect from climate changes and how to adapt.



Tracing metal contamination

Network considers risks of metals on human health

By Arthur Churchyard

Concern about hazardous metals may extend beyond mining towns — trace metals can reach toxic levels in food, soil and dust in many environments. To understand the exact exposure risks, researchers across Canada have teamed up with the University of Guelph to form the Metals in the Human Environment Research Network (MITHE-RN).

Directed by Prof. Beverley Hale of the Department of Land Resource Science, the network was launched to provide sound scientific guidance to Canadian regulators trying to protect human health and simultaneously promote a business climate that supports safe mining and manufacturing. Now in its second year, the network draws together 39 academic and government research projects from across Canada.

“Regulators are obligated to keep people safe, but they also need to protect industry,” says Hale.

Clean-up costs can be crushing for industries that contaminate soil, water and air. It’s often more economical to abandon a plant or refinery than to clean up the area, which means governments or communities are left with the burden.

In some cases, risks may not be as serious as current regulations indicate, says Hale. Metals such as lead, nickel, arsenic and cadmium, for example, can exist in several forms, and only some of these forms may pose serious health or environmental risks. Many forms may be harmless. Identifying and distinguishing safe forms of metals from those that may pose a risk is the major contribution of the network, she says, and this ultimately supports the development of defensible regulations.

The network’s three research areas underline U of G’s strengths: ecosystems, agriculture and human health. Hale notes, for example, that Guelph is one of the few institutions with the facilities and personnel to support her research into how animals absorb cadmium. Other research within the network deals with food concerns. Many crops such as soybeans and corn, for example, take up metals as they grow,

but exactly how this occurs isn’t completely understood.

One project is studying how zinc from animal feeds ends up in manure spread as fertilizer on fields, where it can be carried up into plants and ultimately ingested by consumers. Other studies are examining the health risks of eating unwashed vegetables carrying soil with metal traces, and the risks to children who may inadvertently ingest soil while playing outside.

But it’s not all an outdoors matter. Household dust, which can carry trace metals into the lungs, is usually a result of common household activities and crossover from outdoor particles. Hale says research in this area is also helping turn attention to indoor products rather than contaminated soil outside for metal remediation.

“Through the network, we can learn which metal exposure scenarios pose the greatest risk, then focus resources where they do the most good for human health,” she says.

Three other researchers co-lead the MITHE-RN with Hale: Guelph professor Len Ritter, who heads the Canadian Network of Toxicology Centres, Peter Campbell of Université du Québec and William Hendershot of McGill University.

Joint funding for the network is provided by the Natural Sciences and Engineering Research Council in co-operation with Agriculture and Agri-Food Canada; Environment Canada; Natural Resources Canada; Health Canada; the Ontario Ministry of the Environment; the Ontario Ministry of Agriculture, Food and Rural Affairs; Jacques Whitford Ltd.; the Mining Association of Canada; and the international Ecotoxicity Technical Advisory Panel. ■

Getting the dirt on trace metals and their impacts on food, soil and dust in the environment will help researchers in a new network guide regulations to protect human health.



Information exchange vital for containing avian flu, says expert

By Rebecca Moore

The danger avian influenza poses to Canada's poultry industry is feared by members of the production sector. The stakes are high because poultry and related products play a key role in the success and health of Canada's agricultural industry, particularly in Ontario.

"Southern Ontario has a very intensive poultry industry, and every infectious disease could have a devastating impact," says Prof. Eva Nagy, a virologist in the Department of Pathobiology at the University of Guelph.

Ontario's poultry industry is the largest in Canada, accounting for 35 per cent of national production. With a provincial industry that represents about \$1.6 billion a year, officials don't take chances with disease.

Producers must practise proper biosecurity, which is the first and primary defence against

viral outbreaks, says Nagy. Wild birds may act as reservoirs of influenza virus, and most biosecurity measures include isolating poultry from the outside environment.

But biosecurity can vary from farm to farm, she says. Major outbreaks can result, such as the one in British Columbia's Fraser Valley in 2004. Almost 15 million chickens were killed, resulting in the loss of 410 commercial poultry farms and 553 backyard flocks as officials contained the outbreak caused by a highly pathogenic H7N3 subtype of avian influenza virus.

"The important thing to do during an outbreak is to localize the disease," says Nagy. "If we can do that with poultry during an influenza scare, it will save the industry."

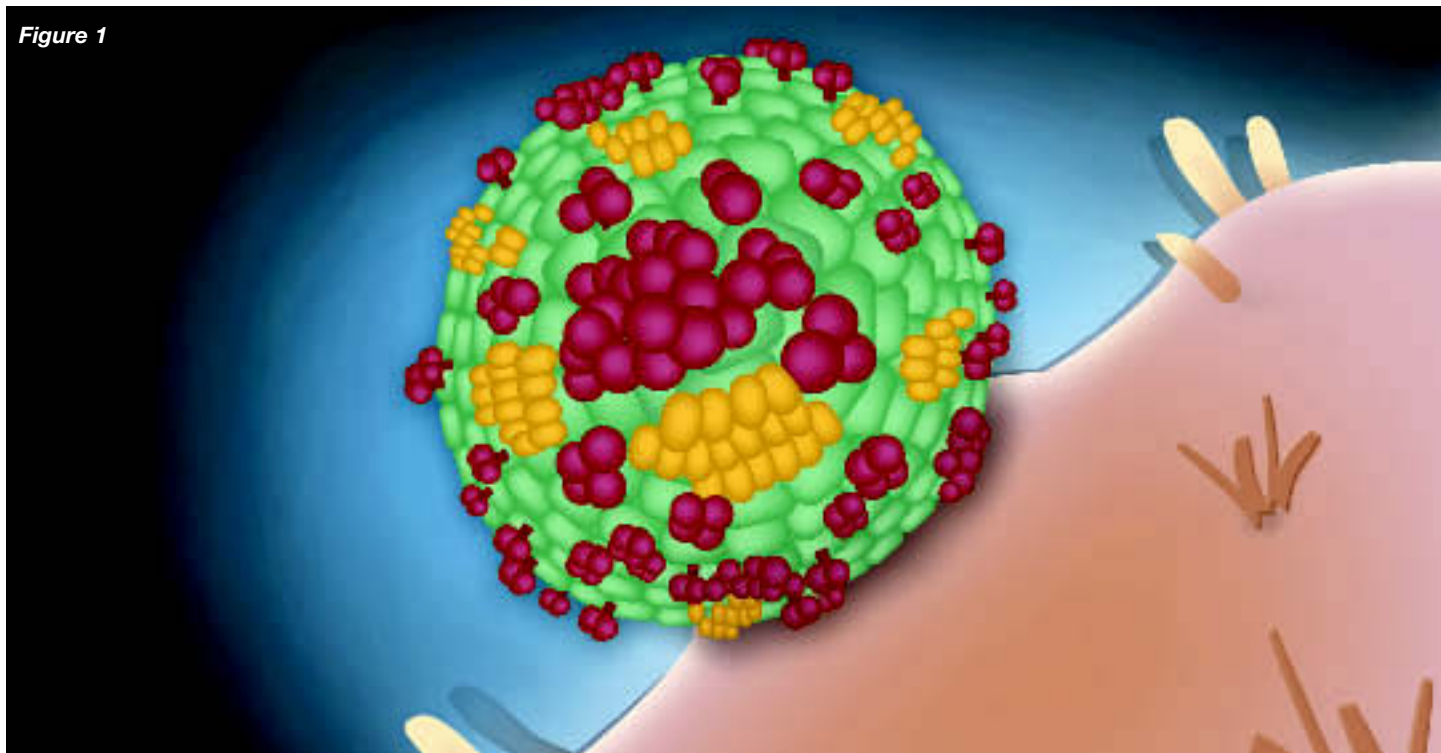
Although the B.C. outbreak progressed further than officials would have liked, it was a

valuable learning experience, she says. And it illustrated the importance of acting quickly to stem the transmission of a virus.

She notes that the monitoring system set up in Canada is a crucial factor in identifying and containing potential epidemics. The current identification of low-pathogenic avian influenza viruses shows the system is working, she adds.

Identifying and containing avian influenza requires producer vigilance, says Nagy. And a key factor in maintaining this vigilance is ensuring that producers and consumers continually receive up-to-date, accurate information. Scientists have a major role to play in this information exchange, she says. ■

Figure 1



Brandon Denard

Figure 2

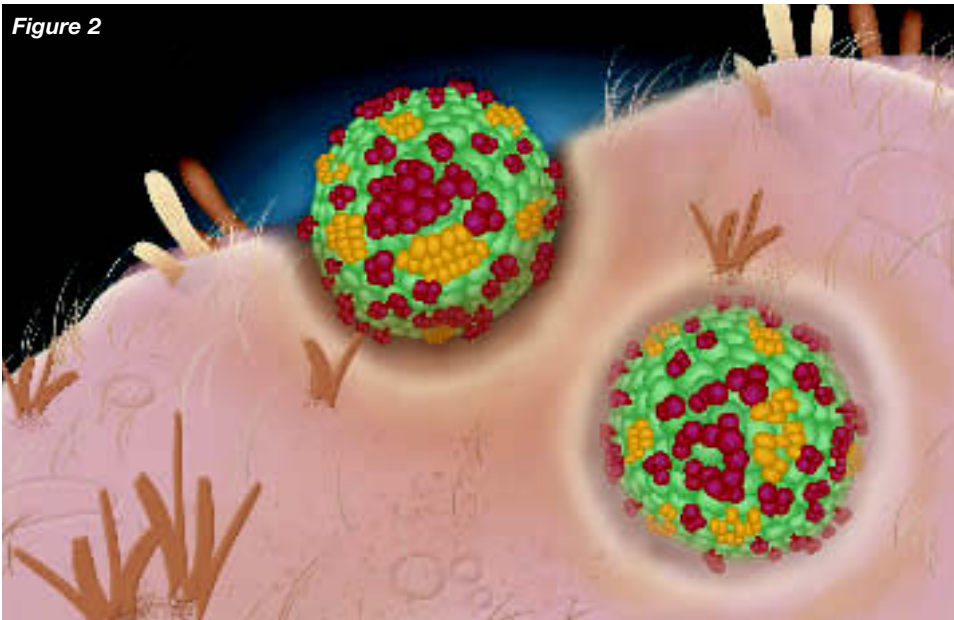
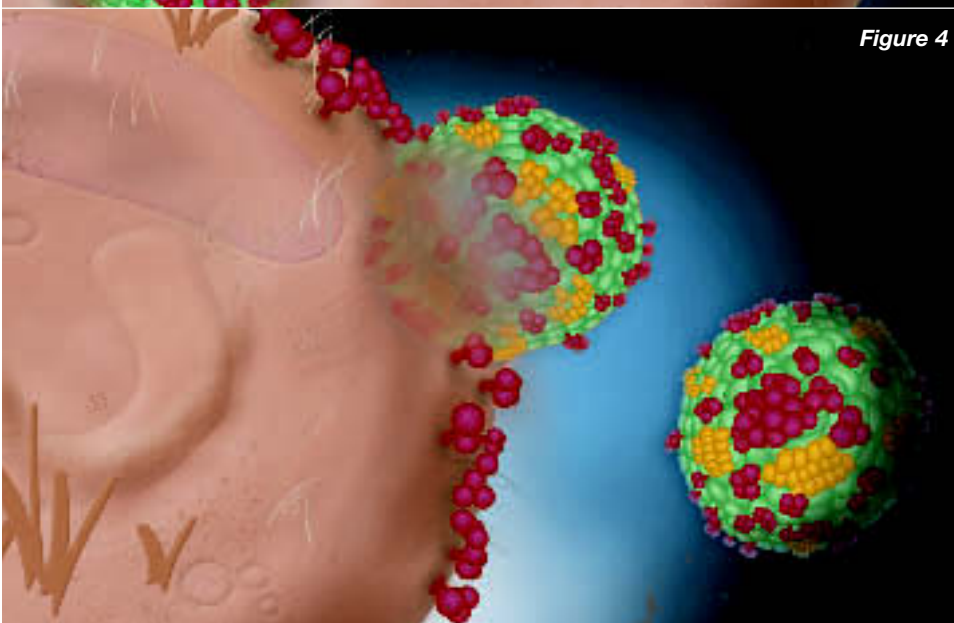


Figure 3



Figure 4



Infection occurs when a complete virus particle called a virion attaches to a susceptible cell (Figure 1). The virion is brought into the cell (Figure 2), where it releases its RNA (Figure 3). RNA, like DNA, is the blueprint for replication and is used to create many copies of the virion's components. Once replication is complete, the components are repackaged to form a new virus particle, which is released from the cell to infect other adjacent cells (Figure 4).

An avian flu primer

- Avian influenza is an infection caused by avian (bird) influenza (flu) viruses.
- Three types of influenza virus exist — influenza virus types A, B and C. The H5N1 subtype of influenza A occurs mainly in birds.
- Avian influenza viruses can be classified as highly pathogenic or low-pathogenic viruses.
- Low-pathogenic viruses cause either no clinical signs or mild signs that can go undetected, such as ruffled feathers and decreased egg production.
- Highly pathogenic viruses cause severe disease in poultry by attacking the internal organs. The mortality rate can reach 90 to 100 per cent.
- Generally, an influenza virus that infects poultry will not infect humans. There are, however, confirmed cases in humans.
- Influenza viruses are constantly changing and may adapt over time to infect and spread among humans.

Keeping tabs on animal disease protects food safety, human health

By Kim Waalderbos

Understanding animal diseases that have been linked to food-borne illness is an important step towards greater food safety and human health protection. To that end, sentinel herds — swine herds maintained as sentinels of health monitoring — have been established across Ontario. By being regularly observed, they can give researchers — and the entire pork industry — an accurate report card on herd health across the province.

For five years, Prof. Robert Friendship of the Department of Population Medicine has studied about 100 herds of varying sizes located across Ontario to track disease prevalence and to begin to understand what factors may influence its spread.

“We’ve been able to get a fairly good idea of how prevalent particular organisms are on pig farms,” says Friendship. “That should help identify how best to reduce risk factors to control disease spread.”

Friendship and his team measured for the bacteria *Campylobacter coli*, *Salmonella* and *Yersinia enterocolitica*, as well as the parasite *Toxoplasma gondii*, which can be passed to pigs by cats. All these organisms can contaminate meat and have been linked to food-borne illness in humans. The team also studied the swine influenza virus.

They found *Campylobacter*, *Salmonella* and *Yersinia* pathogens were widespread in the swine herds. Friendship says this finding means it would not be feasible at this time for the swine industry to implement eradication measures to eliminate these organisms at the farm level, although there may be ways to reduce their presence.

“Strains of these bacteria naturally exist in most pigs,” he says, so measures to reduce the human health risk should be directed at abat-

toirs and at emphasizing good food-handling practices in the home.

He suggests that controlling bacteria will require a farm-to-fork approach that includes ensuring that meat contamination doesn’t occur during processing by carefully handling the intestines where the organisms reside. He also stresses the importance of making sure consumers cook meat properly. Ontario Pork says pork should be cooked to an internal temperature of 70 C.

At the farm level, *Salmonella* can also be controlled by the feeding system used, says Friendship. After comparing management styles

among sentinel herds, he found a lower prevalence of *Salmonella* among herds using coarse feed particles or liquid feeding systems (allows feed to ferment).

He adds that food-borne illness linked to *Yersinia* could become a bigger industry concern in the future because the pathogen can grow in cold temperatures, which are typically not favoured by most bacteria. This concern will likely be tied to export pork products because the pathogen could tolerate refrigeration during long-distance travel to foreign countries. If not cooked thoroughly, the meat containing pathogens can cause gastrointestinal



University of Guelph

disease similar to salmonellosis. Although yersiniosis is much less common than salmonellosis, both have similar disease rates for cases that are directly attributed to pork consumption.

Toxoplasma, which had been a concern in the past, is no longer common in Ontario swine, Friendship found. He says this is due to increased modernization, the cleanliness of barns and the reduced number of cats (which spread the disease). Cysts formed by the parasite in human tissue can cause illness in immune-compromised individuals such as AIDS patients; they can also cause birth defects. This study shows that pigs are now a very minor source of risk.

A new strain of influenza was found to be affecting pigs in the sentinel herds. Friendship says the new strain, which is not a serious concern for humans, arrived in Ontario in spring 2004. Within six months, it had spread to more than 50 per cent of the herds in the concentrated pig-rearing area around Stratford. Affected pigs show classic flu signs such as fever, cough, nasal discharge and sore muscles. Vaccines are available for control.

Friendship says the sentinel herd program has been a valuable monitoring tool to understand disease patterns in Ontario swine. He says it helps ensure the industry is up-to-date and can handle diseases based on knowing if they're becoming widespread or disappearing.

"It's valuable to have herds like this to monitor on a regular basis. It really gives you a sense of the programs you have in place and what more can be done to control disease."

Also involved in this project are Prof. Cate Dewey and graduate student Zvonimir Poljak of the Department of Population Medicine and technicians at the Animal Health Laboratory. This research is sponsored by the Ontario Ministry of Agriculture, Food and Rural Affairs, Ontario Pork and the Ontario Ministry of Health and Long-Term Care. ■

Swine across Ontario are being regularly observed to track the prevalence of diseases linked to food-borne illness.

The raccoon-sized burrowing badger is responsible for the spread of tuberculosis to cattle in Ireland, say researchers.



Wayne Martin

Badgering cattle

Researchers try to make sense of the connection among badgers, tuberculosis, Irish cattle

By Kimberly McKenzie

Despite fierce competition, there seems to be room for everyone to trade food on the global market, provided their food is considered safe. But sometimes it's not. Ireland, for example, is renowned for its fine beef but struggles with a unique situation — grazing cattle there have been exposed to tuberculosis (TB), which officials say is largely spread by wild badgers. University of Guelph researchers have been studying the situation with Irish authorities, trying to make sense of it and assess the true level of danger.

Prof. Wayne Martin and doctoral student Francisco Olea-Popelka of the Ontario Veterinary College's Department of Population Medicine have been working with Irish veterinarians to control the spread of TB from badgers. Research has been ongoing since cattle tuberculosis was seen in badgers in the 1970s. In the early 1990s, one area was cleared of badgers to see what would happen to TB levels in the cattle there. The levels dropped. More recently, this effort has been repeated in four other areas.

The researchers have been examining all aspects of the badger's life, including eating habits, reproduction, settlement and family structure, in concert with scientists from Trinity College and University College Dublin. They've also been investigating how badgers and cattle interact and how TB goes from one to the other.

So far, they've discovered that the strain of TB found in cattle is the same as that found in badgers in the same area. But it's not clear how it's spread. It may be through water sources, through pastures grazed by the cattle that have been contaminated by the badgers or through some other route.

"We don't know how the organism is spread," says Martin. "Traditionally, it's difficult to be

spread orally; it's easier for it to be spread by respiratory means."

Although TB in cattle is a concern for the animals, it's not a serious human health risk, unless you're in Ireland consuming unpasteurized milk, he says. That's rare, however, and the number of cases of cattle TB infecting humans is low. Fewer than 100 people a year in Ireland get TB from all sources, he says. For other parts of the world such as Canada, there is virtually no health risk to humans.

The biggest limitation TB infection creates for Irish farmers is related to trade, says Martin. Many countries won't trade with a country where TB is known to be an issue, and Irish beef is now barred from certain markets. In addition, the ongoing costs to control further spread are high.

The Irish are being proactive in their fight against TB, he says. They test millions of cattle annually to prevent a chronic situation from arising and have found 20,000 to 30,000 cases of the disease each year.

Currently, there is no live TB vaccine available for badgers, but researchers are actively working to create one. A successful vaccine coupled with management changes by farmers and badger population control may keep this disease contained in the future.

This research is sponsored by the Irish Department of Food and Agriculture through the Centre for Veterinary Epidemiology and Risk Assessment at University College Dublin. ■

Insects: Indicators of a

By Laura Kapteyn

It's important to know our neighbours. And if 80 per cent of all animals are insects, then we'd better start getting acquainted.

Insects can tell us a lot about our environment and its health. But before we can learn from them, it's vital to know what they are and their role in the ecosystem. Prof. Steve Marshall, Environmental Biology, and his research team have been working to identify insects and add new species to the University of Guelph's insect collection. They're creating a baseline from which to track species and document changes in insect abundance and distribution.

"If you want to know what's changing, you need to know what's there," says Marshall.

The University of Guelph's insect collection is the oldest in Canada, dating back to 1863. With more than 1.5 million specimens, it ranks as the third or fourth largest insect collection in Canada and the best collection of Ontario insects. It also features world species, including one of the most important fly collections in the world.

Guelph's insect collection, which Marshall dubs a "dynamic database," is always changing and growing under the watch of curator Matthias Buck, Environmental Biology. It tracks an important story of how changes to eastern North American biodiversity are reflected in insect distributions.

Some changes occur naturally, but he believes a high proportion are caused directly or indirectly by humans. Extinction and extirpation (local extinction) of some of the species documented in Guelph's collection are related to myriad factors, he says. The most important are deliberately and accidentally introduced invasive species and habitat destruction through changing land use.

Marshall says these threats to biodiversity have had far-reaching effects on insect populations, some of which are reflected in the collection. On the whole, however, insect fauna remain too poorly understood to properly document — or even detect — many of the ongoing changes to Canadian biodiversity. He notes that a recent insect survey identified a large number of species that had never before been recorded in Canada.

Marshall focuses specifically on taxonomy, which includes identifying insects, studying how they've evolved and looking at where they're distributed. These data can then be used to answer questions about local biodiversity. He believes as many as half of the insect species in Canada are not identifiable because there's not enough taxonomic information available.

That said, he has successfully identified tens of thousands of specimens and discovered and formally named hundreds of species. A large

proportion of the species documented as new to Canada over the last decade were first recognized by Marshall and his students. A recent paper on grasshoppers and their relatives, for example, records nine grasshopper species new to Canada. Another paper on what scientists in the discipline call "true" bugs (such as water bugs and stink bugs) adds more than 30 new records. They've also recorded dozens of new flies, beetles, wasps and even bees, including many known for their potential economic impact.

Marshall is the author of a new book called *Insects: Their Natural History and Diversity: With a Photographic Guide to Insects of Eastern North America*, which contains pictures of hundreds of insects not previously photographed and dozens never before recorded in Canada. He says the book represents a vanguard of a new trend in invertebrate natural history.

"New collections of digital images like those in this book will soon make previously unidentifiable groups, like most insects, accessible to students and naturalists for the first time."

Expansion of Guelph's insect collection is planned, thanks to Canada Foundation for Innovation funding for the Biodiversity Institute of Ontario. Marshall's research is funded by the Natural Sciences and Engineering Research Council of Canada. ■



Kyle Rodriguez

changing environment



Steve Marshall

Identifying this creature and many others has intrigued environmental biology professor Steve Marshall (opposite).

*Understanding insects and their role in the ecosystem can tell us a lot about our environment and its health, but first we need to be able to identify the insects. Among those Guelph professor Steve Marshall is studying are (top) *Oecanthus laricis* (tamarack tree cricket), (bottom left) *Banasa euchlora* (green stink bug) and *Stiretrus anchorago* (anchor stink bug).*

A furry bandit stri

Except this time, instead of invading the trash, it's spreading disease to family pets

By Rebecca Moore

Leptospirosis, a zoonotic infection sometimes found in dogs, can also cause kidney damage or liver failure in humans. And it's re-emerging in Canada with a vengeance. Nationally, the number of reported cases has grown from fewer than 50 a year nearly a decade ago to more than 1,000 in 2005. That's prompting the scientific community, including researchers at the University of Guelph, to examine the roots of the disease more closely and determine to what extent it threatens Canadians.

Leptospirosis in dogs, caused by *Leptospira* bacteria, had been widely contained after an outbreak and subsequent vaccination program started in the 1970s. But a dramatic spike in reported cases caused by different bacteria types resistant to the vaccine began in dogs in the late 1990s, increasing the threat of spread from dogs to humans in urban centres.

Prof. John Prescott, chair of the Department of Pathobiology, attributes the re-emergence of leptospirosis in dogs primarily to raccoons, which are natural carriers of *Leptospira*. As towns and cities sprawl into traditional rural areas, raccoons are becoming increasingly prevalent in urban neighbourhoods, he says, and leptospirosis seems to have become more widespread in the animals.

Dogs are exposed to *Leptospira* bacteria through raccoon urine or urine-contaminated water. The higher proportion of diseased raccoons, combined with an increasingly warmer climate, makes a more hospitable environment for the bacteria. Most cases in dogs are seen in autumn, says Prescott, and over the last decade, this season has become both milder and wetter — conditions favoured by *Leptospira*.

When it comes to humans, however, they're much more likely to get leptospirosis from a friendly lick by an infected dog than from exposure to raccoon urine, he says. That's because the bacteria can be transmitted from dog to owner through saliva. A number of people — mainly veterinary workers but also dog owners — are known to have contracted leptospirosis from dogs in Ontario in recent years.



kes again



Dave Menke, U.S. Fish and Wildlife Service

"In the 1970s, the type of leptospirosis seen was transmitted from dogs to other dogs, so it was easily controlled with vaccinations," says Prescott. "But these new strains are different."

A vaccine is now available to protect dogs from the types of *Leptospira* carried by raccoons. It's not yet considered a core immunization for dogs, as rabies and distemper shots are, but it probably should be, he says. The veterinary community is considering whether to recommend it as a core vaccine, along with other measures that reflect the gravity of the problem.

"This should be a reportable disease," he says, "so when veterinarians diagnose it, they are required to report the finding to the public health sector."

Prescott hopes that with each report, a brief investigation by public health officials would take place to verify that no person has been infected. Currently, the majority of *Leptospira* infections in humans are usually self-diagnosed after people discover they've been in contact with a dog that's been diagnosed with the infection. Because few physicians make the link to possible animal exposure or know about the disease, most cases go undetected by health-care professionals. Increasing communication between the human and animal health sectors would help stem cross-species infections, he says.

In the meantime, Prescott and other researchers, including Beverly McEwen of the Animal Health Laboratory and Prof. Paul Woods of the Ontario Veterinary College's small-animal clinic, are following the re-emergence. Prescott hopes to further analyze information that's been collected to quantify the susceptibility of certain canine breeds to leptospirosis and to gain more ground in determining the disease's prevalence.

This research is sponsored by OVC's Pet Trust Fund. 

Researchers say raccoons are responsible for the re-emergence of a kidney and liver disease in dogs.

New seeds bring improved health and food security

By Patricia Dickenson

Hunger in Honduras is being alleviated by farmers with new seed varieties developed through what's called participatory breeding — the farmers themselves developing crops with the traits they want.

For the past 13 years, Prof. Sally Humphries, director of the University of Guelph's collaborative international development studies program, has been working in this Central American country with the Foundation for Participatory Research for Hillside Farmers. It's a non-governmental organization that helps organize and support farmer research teams. Humphries began collaborating with farmer researchers while working for the International Centre for Tropical Agriculture prior to her arrival at Guelph.

In 2000, USC-Canada began funding Honduran farmer researchers through its Seeds of Survival program, which included support for participatory breeding. The project involved plant breeding by farmers in four communities and led to two higher-yielding local maize varieties — Capulín Mejorado and Santa Cruz — and one improved local bean variety — Macuzalito.

The stature of the maize plants has been decreased to prevent some of the wind damage caused by hurricanes. And because the varieties are being developed from local stock, they're better suited to the environment and growing conditions than breeder-improved varieties.

Humphries says the breeding program has been so successful — with a 23-per-cent yield increase in corn — that she believes local food security is within reach.

Historically, the hunger problem in Honduras has been caused by inequitable access to land, leaving most farmers with tiny hillside plots and crop yields that are too low during the

growing season to last through the entire dry season. Crops can be grown only between June and November, during the rains. Food shortages occur from June to August each year — known locally as “los juniros” — when food from the previous year is gone and new crops aren't yet available.

It's these food shortages that lead to malnutrition and cause the wide range of health-related problems facing rural Hondurans. In the countryside, almost 48 per cent of children are affected by malnourishment or height deficiency, compared with 29 per cent in urban areas.

The new seed is expected to lead to significant improvements in food security among local farm families. Already, the families of the farmer researchers, who use a variety of conservation practices in addition to locally improved seed, have seen their hungry period reduced

from 5.5 weeks to 1.5 weeks. Farmer researchers are trying to scale up seed production, so the new varieties can be used in other areas. Although they were developed for high elevations in one region of Honduras, they're being tested for viability in other parts of the country through a federation of farmer researchers.

“What's so important about participatory breeding methods is that farmers control the process themselves,” says Humphries. “This allows them to continually adapt their crops to changing environmental and market conditions. Having this level of control is very empowering.”

This approach to plant breeding is attracting interest across Canada. Selecting for yield and size on the farm could be used in organic farming to create organic plant varieties with increased yields and better plant health. ■

Honduran farmers are working to alleviate hunger in their country by developing seed varieties that will better thrive in local growing conditions.



Sally Humphries

An eye on food safety

By Rebecca Moore

Food safety begins on the farm, long before meat, poultry, eggs and dairy products find their way to consumers. To ensure that animal food sources are safe, healthy and disease-free, the University of Guelph's Animal Health Laboratory (AHL) stands vigil.

The lab is Ontario's centre for animal health testing, the first line of protection in the food production chain. Food-animal veterinarians from across the province submit more than 30,000 samples to the lab for analysis every year, generating close to 700,000 tests.

AHL director Grant Maxie says the lab's role includes protecting human health.

"Our mandate is to help keep food animals as healthy as possible, so that they and their products are fit for human consumption," he says. "We consider it on-farm food safety."

Samples received by the lab are tested for a variety of pathogenic microbes, heavy metals and other toxins to ensure that food animals are in good health to produce meat, milk and eggs for consumers. Maxie says rigorous testing has become increasingly important with the current attention being placed on zoonotic diseases (ones that can be transferred from animals to humans).

Salmonella, for example, is an age-old zoonotic agent and food-safety concern. Avian influenza, although not a concern from the food-safety standpoint, has garnered much media attention because of possible disease transmission from live birds.

To help ensure that outbreaks from a wide range of pathogens are quickly detected and contained, the lab monitors test results for all submissions, says Maxie. If a reportable or notifiable condition is detected through testing, the lab notifies regulatory agencies.

"The lab takes the collected information and provides the necessary data to governmental organizations," he says. "We identify, confirm and alert the proper people."

Among the key organizations that the lab reports to are the Canadian Food Inspection Agency and the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA). In addition to its fee-for-service revenue, the lab receives funding from OMAFRA. ■



Keeping a handle on food safety to protect public health means Grant Maxie and his Animal Health Laboratory conduct more than 700,000 tests each year.

Kyle Rodriguez

National surveillance of wildlife disease is co-ordinated effort

By Heather Filby

Prompted by the spread of a deadly strain of avian influenza, University of Guelph researchers — as part of the Canadian Co-operative Wildlife Health Centre (CCWHC) — are helping to design and implement surveillance systems to monitor zoonotic diseases (ones that can be passed from animals to humans).

Two of the surveillance systems — Canada's Inter-Agency Wild Bird Influenza Survey and Canada's West Nile Virus Surveillance Program — provide early detection of diseases in wild migratory birds such as ducks, geese, eiders, terns and sandpipers, as well as crows, blue jays and other species. CCWHC staff pathologist Doug Campbell says the information collected in the studies will provide a realistic perspective of the risk to humans and domestic poultry, and will help guide public health policy and education programs.

"The core of the centre and these programs involves both detecting disease and disseminating reliable information to concerned groups, media, government and the public," says Campbell.

So far, researchers in the network have found several strains of avian influenza in wild birds. Although prevalence varies provincially among different species, about 37 per cent of wild birds carry some strain of avian influenza. The viruses are non-deadly and are not transmitted from bird to human.

A new strain of avian influenza, H5N1, is different. It can cause mortality in some bird species, and occasionally people who have associated closely with infected birds have become ill and died. The virus, which originated in Asia, has spread to the Middle East and Europe. Although it has never been detected in North America, researchers are concerned that wild birds migrating from Europe could introduce the strain to Canadian flocks. Campbell says the surveillance systems are monitoring potential carriers to determine whether foreign viruses such as H5N1 can be transmitted during transatlantic migrations.

He says the centre's studies also identify toxins and environmental pollutants that can affect wild and domestic animals. In addition, they monitor disease outbreaks that could be devastating to rare or endangered bird species such as loggerhead shrikes and trumpeter swans.

Campbell, along with Katherine Welch and regional co-ordinator Prof. Ian Barker of the

Department of Pathobiology, belongs to the Ontario-Nunavut regional centre, one of five CCWHC regional units. The units are located at Canada's four veterinary colleges in Guelph, Charlottetown, P.E.I., Saint Hyacinthe, Que., and Saskatoon, Sask., and at the Centre for Coastal Health in Nanaimo, B.C.

Although the surveillance systems are national, more than a third of all Canadians live in Ontario, making it one of the most likely areas for human-wildlife interactions and often the first place zoonotic diseases occur, says Campbell. The Guelph team investigates wildlife mortalities, cruelty cases and animal attacks on humans that occur in Ontario and Nunavut.

Not many regions have the human resources to collect specimens, says Welch, so the CCWHC relies on concerned members of the public who report suspicious deaths.

"One of the first steps is to foster interest and promote awareness of the services we provide," she says.

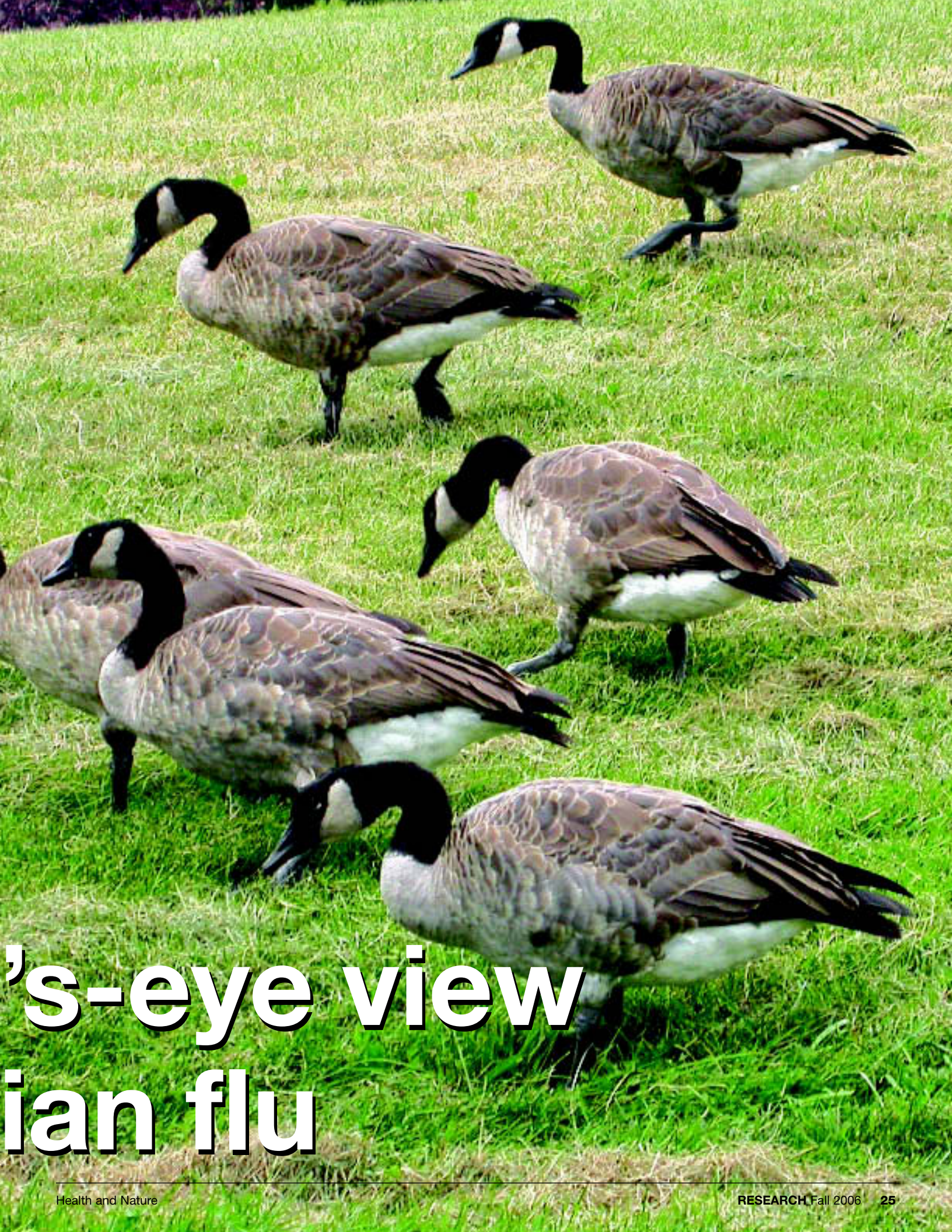
Through research publications, seminars and presentations to naturalist clubs and other groups, the team is spreading knowledge about West Nile and other wildlife diseases, and is providing a source of information to help guide Canada's preparation for the potential arrival of H5N1 avian influenza.

This research is supported by Environment Canada — Canadian Wildlife Services, the Atlantic Veterinary College, Faculté de Médecine Vétérinaire, the Ontario Veterinary College, the Western College of Veterinary Medicine, the Canadian Food Inspection Agency, the Canadian Wildlife Federation, Ducks Unlimited Canada, Fisheries and Oceans Canada, Health Canada, the Max Bell Foundation, Parks Canada, the Public Health Agency of Canada, Syngenta Crop Protection and the Canadian government's 10 provinces and three territories. The CCWHC's Ontario unit is also supported by the Ontario Ministry of Health and the Ontario Ministry of Natural Resources. ■

Canadian geese and other migratory birds are being monitored for disease through two Canada-wide surveillance programs.



A bird of av

A group of five Canada geese are standing in a lush green grassy field. The geese have brown and grey mottled feathers, black heads, and white necks. They are scattered across the frame, with one in the upper right, one in the upper left, and three in the lower half. The text 's-eye view' and 'ian flu' is overlaid in large white letters on the bottom left.

's-eye view ian flu

Contributors

www.uoguelph.ca/research

Research magazine



Alicia Roberts

Fourth-year drama student Alicia Roberts doesn't confine herself to the stage: soccer and sunshine pull her out from behind the scenes. The Chatham, Ont., native enjoys playing her favourite sport on campus, as well as travelling bike paths through Guelph's own Arboretum. See her story about developing a deeper understanding of epilepsy on page 31.



Rebecca Moore

Rebecca Moore is trading the sunlight for city lights. After completing a degree in history and microbiology at Guelph, the Brantford, Ont., native is moving on to a master's in science history at the University of Toronto. When she's not hitting the books, you can find Rebecca hiking local trails. See her story on a re-emerging urban disease on page 20.



Kim Waalderbos

Co-ordinating this 48-page *Research* magazine has kept agricultural science major and SPARK co-ordinator Kim Waalderbos closer to her computer than the outdoors. But that hasn't dampened her rural spirit; she still uses every chance she can to grab some fresh air by walking through the campus gardens. Kim, who came to Guelph from her family's dairy farm near Amherst, Nova Scotia, loves going back to help with chores and work in the fields.



Heather Filby

Mathematics graduate Heather Filby developed a passion for the outdoors while growing up on rural Manitoulin Island, where she learned to canoe, snowshoe and hike in the



Kate Roberts

Kate Roberts, a fourth-year marketing student, loves spending time outdoors in the warmer months — whether it's playing beach volleyball, swimming with her



Arthur Churchyard

Links between science and public issues are the focus of Arthur Churchyard's second-year studies as an arts and science major. When not writing research articles, he exper-

mountainous wilderness of Killarney Provincial Park. This fall, Heather is headed for Ontario's City of Trees, London, Ont., to complete her teaching degree at the University of Western Ontario. Turn to page 24 to read her story on new monitoring programs for tracking diseases in wild birds.

nephew, camping or fishing on Buffy Lake, near Kingston, Ont. As a dog lover, and with her own pooch named Moe, Kate was interested to learn how dogs used in hospital visitation programs can potentially transmit disease to humans. For more, see page 6.

inments with plants in his own backyard vegetable garden. He was intrigued by studies that look at metal contamination in crops and soils. Read more on page 12.



Jen Christie

Jen Christie's recent agricultural business degree has led to a marketing position with John Deere Ltd. When she is not traversing the Ontario countryside between dealerships, she spends her time outdoors snowboarding, snowmobiling, golfing, wakeboarding and helping on the family dairy farm near Tara, Ont. Jen explores a landscape unfamiliar to most of us in her story on "foodscapes" on page 41.



Katie Cheesmond

Fourth-year agricultural business student Katie Cheesmond spends most long summer nights creating sizzling sensations on her trusty BBQ. Originally from England and now residing in Guelph, she brings a truly international flavour to her cuisine. See Katie's story about the hidden truths of caffeine consumption on page 43.



Katie Savage

Katie Savage, a fourth-year agricultural science student, spent most of her summer in Guelph working for agricultural chemical company BASF doing trials in the field, but she takes every opportunity she can to visit the country and her family farm near Bradford, Ont. She enjoys spending her spare time working with her 4-H calf and showing it at local fairs. Turn to page 45 to read her story about realities of trans fats.

This issue's contributors' photos were taken at the Arboretum, the University of Guelph's unique nature nook. Perhaps no other facility on campus more plainly exemplifies Guelph's connection with nature. The Arboretum sports 408 acres of trees and shrubs native to southern Ontario, as well as elaborate gardens and more than eight

kilometres of public trails. The Arboretum is a popular site for Guelph researchers involved in botanical and genetic plant studies, owing to initiatives such as the Rare Woody Plant Gene Bank, the Elm Recovery Project and the Ontario Tree Atlas. For further information, visit www.uoguelph.ca/arboretum.



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

UNIVERSITY of GUELPH

Functional foods: Long time coming, here to stay

By Kim Waalderbos

Today's interest in functional foods — those that offer health benefits beyond basic human nutrition — was preceded by more than a decade of research at Guelph. Back then, interest was shared by only a few, including scientists studying how to boost milk, an already nutrient-rich food.

In the fall 1998 *Research* magazine, Prof. Brian McBride and graduate student Tom Wright, Department of Animal and Poultry Science, along with nutritional sciences professor Bruce Holub, were profiled about their work enriching cow's milk with an omega-3 fatty acid called docosahexaenoic acid (DHA).

DHA was known as an essential nutrient that contributed to the optimal development of the brain, eye and nervous system. Despite these benefits, food sources of DHA were traditionally limited to fish and fish oils.

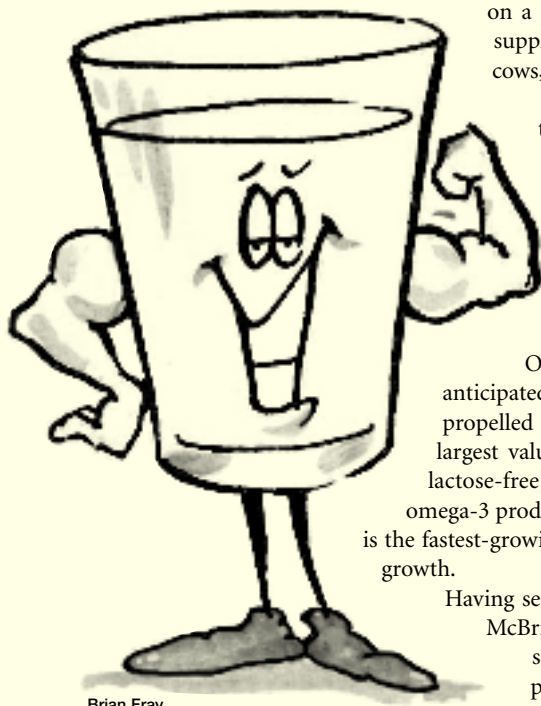
Knowing this, the Guelph researchers embarked on a program to develop a special animal feed supplement using fish meal that, when fed to cows, could enrich their milk.

Over the years, the researchers fine-tuned that supplement and built on their ability to successfully feed the diet to cows and beneficially enrich the milk produced.

The years of research and development efforts culminated in April 2004 with the commercial launch of DHA-enhanced milk by a major dairy, Neilson's. The product called Dairy

Oh! caught on with consumers better than anticipated and is now a staple on store shelves. It has propelled omega-3 products to become the third largest value-added milk segment (after filtered and lactose-free). Dairy-Oh! represents 90 per cent of omega-3 product sales only two years after its launch and is the fastest-growing milk segment with 20-per-cent volume growth.

Having seen the process through from its inception, McBride says it's "very gratifying to develop something from idea creation to marketplace that contributes to the health of Canadians." ■



Brian Fray

For further reading

Visit

www.c-ciarn.uoguelph.ca to learn more about how climate change is affecting agriculture and how the Canadian Climate Impacts and Adaptation Research Network is bringing researchers together to develop better adaptation strategies.

View

www.ciat.cgiar.org for updates on the International Centre for Tropical Agriculture and researchers' efforts to reduce hunger and poverty in developing and underdeveloped countries.

Visit

<http://wildlife1.usask.ca> to learn more about how veterinarians at the Canadian Co-operative Wildlife Health Centre are improving wildlife health and conservation methods.

Read

Insects: Their Natural History and Diversity (Firefly Books, 2006) to see more than 4,000 photographs of eastern North American insects, along with descriptions of their habitat and history.

Visit

www.gftc.ca to catch the latest food industry news and events from food scientists at the Guelph Food Technology Centre.

Visit

www.hc-sc.gc.ca/fn-an/food-guide-aliment/index_e.html for advice on how to meet your nutritional needs using Canada's Food Guide.

Check

www.cancer.ca to learn more about ovarian cancer and the advances being made in cancer prevention research.

Visit

www.mithe-rn.org/mite_rn to find what researchers from the Metals in the Environment Research Network are uncovering about the effects of metals on environmental and human health.

Visit

www.phac-aspc.gc.ca/pau-uap/paguide/child_youth/index.html for ideas about helping young people stay healthy and active using Canada's Physical Activity Guide.

Exercise can help curb obesity, type 2 diabetes

By Kayla Duffield

U of G researchers are working to better understand how exercise and adrenalin can burn fat and help curb the growing epidemic of obesity and type 2 diabetes in Canada.

“The beautiful thing about exercise,” says Prof. Lawrence Spriet, Human Health and Nutritional Sciences, “is that it helps muscles get better at using fat.”

Spriet is looking at the metabolic reasons why people become overweight and how extra weight can lead to type 2 diabetes. He’s taking muscle samples from three groups of middle-aged men (obese, type 2 diabetics and lean) to observe what’s happening inside their muscles and to understand how the body uses fat and carbohydrates.

“The advantage of our research is that we are actually taking measurements inside the muscles,” says Spriet. “Less invasive techniques are less accurate.”

Healthy people readily metabolize fat and carbohydrates into energy, but type 2 diabetics do not, he says. They become resistant to insulin, which prevents the body from using glucose or sugar, the basic fuel of cells. Normally, insulin helps take glucose from the blood and feeds it to the cells, but in diabetics, glucose accumulates in the blood. Over the long term, excessive sugar can hurt the eyes, kidneys, nerves and heart, and cause excessive thirst, hunger, urination and fatigue.

Unable to use sugar, cells must rely on fat for energy (taking it from the blood). But this is also a flawed process in diabetics, says Spriet, because the fat accumulates in muscle.

An associated fat burner in muscle tissue is the enzyme hormone-sensitive lipase, which helps unlock the fat that is stored in the muscle for fuel. He is conducting eight-week cycling programs to test how lipase is affected by exercise. Moderate exercise or adrenalin usually turns it on, but inactivity — common to obese people or type 2 diabetics — turns the fat-burning enzyme off. Through his research, Spriet hopes to prove moderate exercise will activate the lipase enzyme, promoting active living.

Also involved in this research were Rebecca Tunstall and Jane Rutherford, Department of Human Health and Nutritional Sciences. Funding has been provided by the Canadian Institutes of Health Research. 



Kyle Rodriguez

Exercise can help curb obesity and type 2 diabetes, say University of Guelph researchers.

eat epilepsy

treat humans



Kyle Rodriguez

Here's another reason why dogs deserve best-friend status: They could provide new information about diagnosing and treating epilepsy.

Epilepsy, a neurological condition affecting the nervous system, is found in dogs and humans. Prof. Roberto Poma, a veterinary neurologist at the Ontario Veterinary College, says a better understanding of canine epilepsy may help with treating the condition in humans.

"In a clinical setting, we often jump from clinical symptoms to treatment of epilepsy," says Poma. "What we're looking at is the information missing in the middle, which will help us characterize epileptic syndromes in dogs and hopefully provide valuable support to investigate human epilepsy."

He and his research team hope to characterize specific breed-related epilepsy syndromes and compare them with human epilepsies. Even within dog breeds, seizure type and neurological signs vary. Understanding these variations is important for proper diagnosis and treatment, he says.

The pilot study involves three common breeds suffering from canine idiopathic epilepsy (having no known cause for the disease): the golden retriever, Australian shepherd and Nova Scotia duck tolling retriever.

To characterize conditions properly, Poma uses the following diagnostic tests on each dog. He begins by gathering information on the dog's history and performing a neurological examination. A magnetic resonance imaging (MRI) of the brain is performed to rule out primary abnormalities. He also conducts electroencephalography (EEG) to investigate brain electrical activity in epileptic dogs. For this, he uses two types of equipment — a routine EEG system for patients in hospital and an ambulatory system adapted for dogs in their home environment.

Because most dogs suffering from idiopathic

epilepsy tend to have seizures at night — and often only in their home environment — using the ambulatory technique will allow researchers to monitor patients more precisely, Poma says.

Both EEG systems can be synchronized with video monitoring to help compare the clinical symptoms observed with abnormal brain electrical activity experienced by the dog during a seizure. For example, if the dog has recurrent "twitching" of the left front limb during a seizure, the EEG may display abnormal epileptic "spikes" in the right part of the brain.

Canine epilepsy often results in frustrating outcomes because dogs can be resistant to conventional treatment with antiepileptic drugs. An alternative research treatment called transcranial magnetic stimulation (TMS) is currently available at OVC. Non-invasive and painless, it uses magnetic stimuli to influence brain electrical activity and reduce the likelihood of a seizure occurring. It is paired with sophisticated imaging software called Brainsight, which reconstructs a 3-D image of the dog's brain from the MRI and helps guide the placement of magnetic stimulation to target the affected epileptic site.

TMS has been widely used for treating human neurological conditions such as depression, mood disorders, Parkinson's disease, Alzheimer's, schizophrenia and epilepsy.

Poma hopes to further link his findings to genes in dogs and humans. He plans to use his improved understanding of the disease to locate abnormal genes and map the causes of epilepsy. He'll be working with Dr. Berge Minassian, a neurologist, epileptologist and geneticist at Toronto's Hospital for Sick Children.

Also involved in this study are graduate student Fiona James of the Department of Clinical Studies and epilepsy researcher John Ives of the University of Western Ontario.

This work is sponsored by the Canada Foundation for Innovation. ■

Veterinary neurologist Prof. Roberto Poma and neurology technician Jennifer Collins are finding new information about diagnosing and treating epilepsy in dogs that they hope can be applied to humans with the condition.

Working to b

Research at the Ontario Veterinary College could help

By Alicia Roberts





Giving the brain a boost

Research ties hormones to increased synaptic function

By Rebecca Moore

Estrogen and androgen, two common groups of hormones, are known for their effects on the human reproductive tract. But Guelph researchers say they may have another function in the human body — in the brain.

Prof. Neil MacLusky, chair of the Department of Biomedical Sciences, says estrogen and androgen may help improve memory and synapse formation (the bridges between nerves that enable movements and responses to occur), warding off diseases such as Alzheimer's, Parkinson's and other forms of dementia.

"It turns out that androgens and estrogens are important to maintaining the health of the brain," he says, "and they have a huge impact on synapse formation and memory."

Recent research has found that estrogen and androgen enhance brain function by improving synapse formation in the hippocampus, an area of the human brain that is important for committing experiences to memory. These hormones decrease naturally with age, and this may be a contributing factor to age-related mental degeneration, MacLusky says.

He notes that maintaining mental health is becoming a primary concern for the public health sector. Among his research projects, he is studying the potential of natural estrogen sources to reduce the impact of hormone deficiency-related aging.

His timing couldn't be better. One in 10 people over the age of 65 and nearly half of those aged 85 or older have Alzheimer's disease. The situation represents a potentially serious public health risk as life expectancy continues to rise.

"With the increasing likelihood of neurological problems as we age, we are potentially looking at a public health nightmare," says MacLusky. "It would prove to be a terrible bur-

den on families, caregivers and the public health system if we don't find solutions."

In one project, he and a team of researchers at Toronto's Sunnybrook Health Sciences Centre are studying the impact of using estrogen therapy on aging women who are beginning to show symptoms of Alzheimer's. Early results look promising, and the team hopes to shed light on the potential of hormone therapy to reverse or at least slow some mental degeneration.

Using hormone therapy to tap into the perceived benefits of estrogens and androgens is not simple, says MacLusky. Because most currently used hormone therapies have more than one effect, patients hoping to gain a mental edge may also run the risk of developing cancer and other health consequences. But these problems may be overcome because of the potential for developing more specific hormone therapies, capable of triggering synapse formation in the brain without other adverse effects.

The estrogens present in soybeans, the so-called phytoestrogens, represent one possible example. Initially, these estrogens were thought to have minimal impact on the human body because the receptor that allows estrogen to trigger synapse formation was unknown . . . until now. MacLusky's research is finding that, at least in animals, low doses of phytoestrogen have a major impact on synapse formation in the brain, without stimulating undesired growth responses elsewhere in the body.

The next step is to identify the exact composition of this hormone receptor. Then it will be easier to determine what hormones may be best suited for brain health, he says.

His research is funded by the Canadian Institutes for Health Research and the U.S. National Institutes of Health. ■

Prof. Neil MacLusky, Department of Biomedical Sciences, is studying how two common groups of hormones can boost brain function and memory.

Kyle Rodriguez

Thinking big

The expanding field of
neuroscience at Guelph

By Rebecca Moore

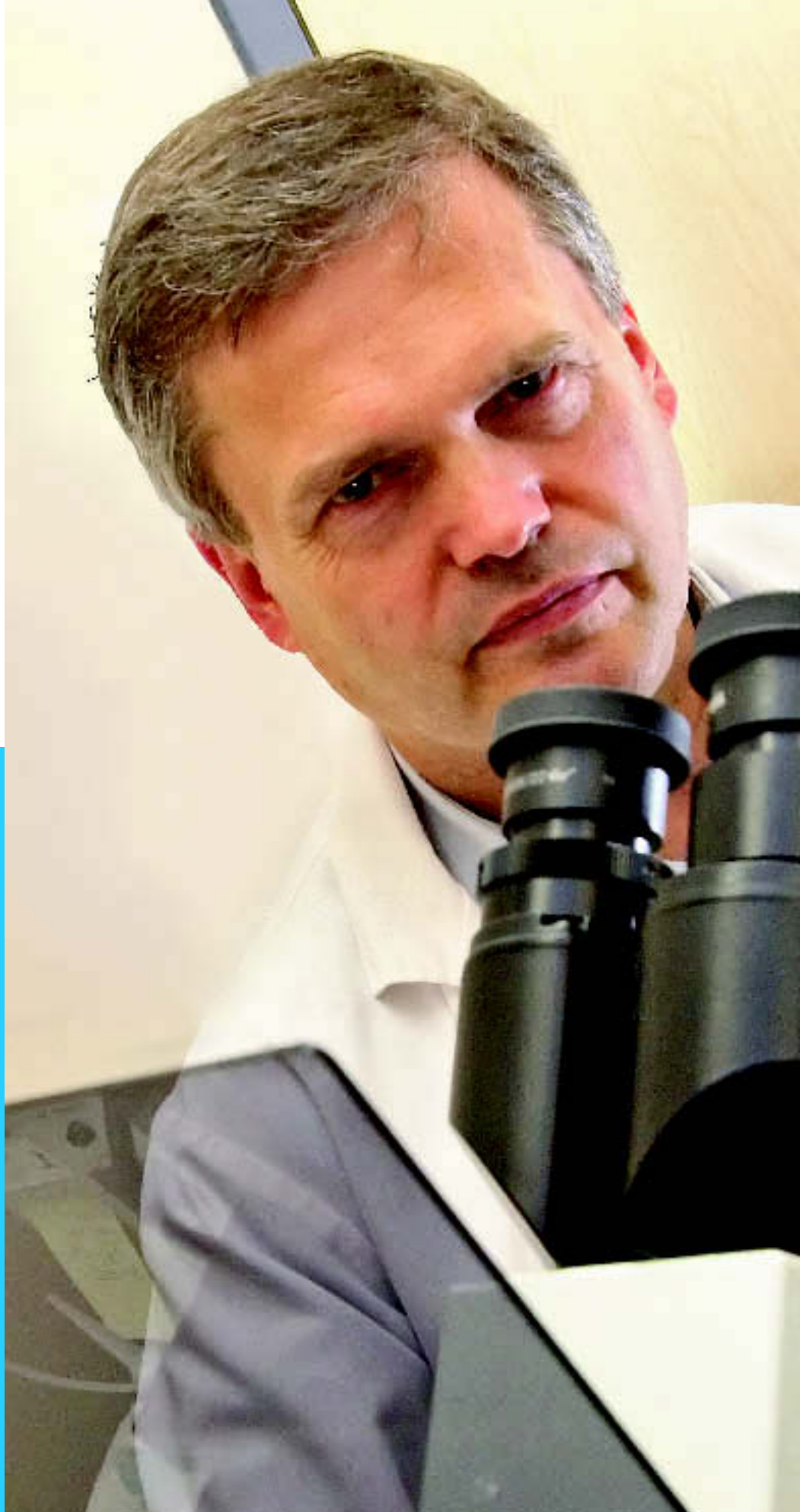
Neuroscience at the University of Guelph is growing by leaps and bounds, thanks to the addition of five new neuroscientists in the last four years, including Prof. Neil MacLusky, chair of the Department of Biomedical Sciences. The additions have enhanced Guelph's research breadth and are the beginning of something much bigger, MacLusky says.

Plans call for ultimately developing a full neuroscience major at Guelph, building on unique opportunities and resources for neuroscience through ties among the College of Biological Science, the Department of Psychology and the Ontario Veterinary College (OVC).

"Many health problems that are seen in animals will have a direct spinoff in human health," says MacLusky. "Having an affiliation with OVC is good for neuroscience and many other research areas because it provides access to animal research that can provide unique insight into human health."

Prof. John Armstrong, a new faculty member in the Department of Biomedical Sciences, exemplifies the connection between OVC and human health. Working out of U of G's Institute for Animal-Human Links in Health Science Research, he is studying the effect that disrupted neurons have on behaviour and learning. The institute will promote collaborative research throughout the biomedical sciences sector.

"The addition of neuroscientists at Guelph represents a positive change for the neuroscience community," says MacLusky.



Guelph researchers tackle ovarian cancer

By Mitch Ritter



Biomedical sciences professor Jim Petrik (left) and PhD student Jim Greenaway are observing cell cultures to better understand how ovarian cancer cells develop and grow so they can enhance treatment.

Kyle Rodriguez

The most aggressive and lethal form of cancer among women — ovarian cancer — is being targeted by a biomedical scientist at the University of Guelph.

Prof. Jim Petrik is working to gain a better understanding of how ovarian tumours develop and grow. His research could ultimately enhance treatment.

Ovarian cancer is a poorly understood disease. It can present itself as a number of different types of afflictions, making it difficult to detect. Better understanding its cause and how tumours grow is the first step in developing effective treatment plans, says Petrik.

“Anything that can be done to improve treatment outcomes will have a significant impact

on the length and quality of life for those individuals suffering from this disease.”

Specifically, he’s studying the use of a molecule called thrombospondin to prevent the formation of blood vessels that supply blood to cancer tumours in ovaries. His research could potentially lead to the development of powerful therapies to combat or prevent the disease.

The next step is to study angiogenesis — the growth of new blood vessels — and its role in regulating ovarian tumour formation, says Petrik. An angiogenesis inhibitor is derived from a protein produced in the body and could be a safer treatment option than some traditional chemotherapy, he says.

PhD student Jim Greenaway has been a vital

part of the project’s success, says Petrik. Greenaway has generated an animal model of the disease that spontaneously develops ovarian tumours in a fashion similar to how the human disease progresses.

Others involved in this research include Prof. Roger Moorehead of the Department of Biomedical Sciences and Dr. Jack Lawler of Harvard University’s Department of Medicine and the Beth Israel Deaconess Medical Center. ■

Preventing chronic illness after spinal cord injury

By Rebecca Moore

Some 40,000 Canadians are living with spinal cord injury (SCI), and another 1,000 are added to the list each year. Medical advancements are ensuring that more and more people survive the trauma that caused their SCI, but the ensuing years bring a whole new range of health concerns.

Because of decreased mobility, those with SCI are up to four times more likely to develop

type 2 diabetes, have an increased risk of coronary heart disease and suffer from higher rates of obesity than the able-bodied population does.

Dealing with these emerging health problems is no small task. There are no guidelines for proper exercise, diet or weight indexes for people with SCI, even though the mortality rate from obesity and cardiovascular disease is high-

er among this demographic.

Prof. Andrea Buchholz, Family Relations and Applied Nutrition, is among a small group of pioneering scientists working to ensure that SCI patients have adequate guidelines for proper diet and exercise as a proactive measure against illness.

"People living with SCI have a metabolism that is very different than that of able-bodied individuals," says Buchholz, "and yet the current dietary and exercise interventions for people with SCI are the same as those for people without."

She is co-investigator on a study that aims to improve the quality and longevity of life for people with SCI by determining the prevalence of risk factors for chronic illnesses, how much exercise is required for maximum impact to decrease these risk factors, and how diet figures into the equation. Along with primary investigator Kathleen Martin-Ginis of McMaster University, Buchholz hopes to produce guidelines for dietitians and physiotherapists to ensure that people living with SCI are proactively working to prevent chronic health problems such as coronary heart disease.

Buchholz is also the primary investigator on a study looking at the impact of visceral fat — fat found deep inside the belly — on the risk of long-term health problems for those with SCI.

Funding for the joint study between McMaster University and the University of Guelph is provided by the Canadian Institutes of Health Research. The visceral fat study is supported by the Canadian Foundation for Dietetic Research. 



Kyle Rodriguez

Prof. Andrea Buchholz measures the waist circumference of spinal cord injury research participant Cyndy McLean. This information is used to help determine lifestyle interventions that can reduce the risk of obesity-related conditions in people recovering from spinal cord injuries.



Magazines: Where most people get their information about nutrition

A 2005 study conducted by University of Montreal researchers in conjunction with Dietitians of Canada found that Canadians receive their nutritional information from a variety of sources.

Of those surveyed, almost half reported looking to magazines for information about nutrition. Others cited books (42 per cent) and food labels (37 per cent). Respondents also said they use the Internet and brochures for specific health topics.

Study participants said they were most confident about the nutritional information coming from dietitians (88 per cent), physicians (61 per cent) and the government (53 per cent).

Kyle Rodriguez

Dietitians at fore of health-care reform

By Megan Nuttall

Canada's primary health-care system is changing. It's still mostly based on reactive measures to treat disease, but \$800 million in federal funds has been spent to promote the transition to interdisciplinary primary health care. The goal is to establish effective community-based primary health-care systems.

Dietitians — professionals who work in the health and food sectors to identify issues and solve problems in nutrition and diet — will be a part of these new systems. Prof. Paula Brauer, Family Relations and Applied Nutrition, and her colleagues have invested the past two years in developing an integrated primary health-care model that places dietitians right in the doctor's office.

In the past, dietitians have been employed largely in hospitals, private clinics, the food-service industry, education and research. Having dietitians in family physician offices will give them a more direct role in early and diagnostic health management, says Brauer.

"This will help patients navigate through the wealth of generalized health and nutrition information that's available through traditional channels such as magazines and the Internet, and help them receive specific information regarding their personal health-care issues."

This model differs from the referral-based system currently in place. Brauer believes the integrated model is especially relevant to people who have complicated health issues that feature a variety of symptoms. This is often the case in the baby boom generation, where the incidence of diabetes and other health problems related to diet and nutrition is on the rise.

"It's all about personalizing and individualizing advice pertinent to that patient's health-care issues," she says.

The integrated model has been tested as a pilot project in Family Health Networks in Kingston, Parry Sound and Stratford, Ont., with an overwhelmingly positive response. In one survey, a doctor said the registered dietitian was "a very valuable addition to our services. Treatment for obesity and cholesterol issues is vitally important and the patients loved having this accessibility. Given the high proportion of our population with obesity, this kind of early attention is critical to reducing future burden to the health-care system."

This is good news for Brauer, who expects great things from this kind of program in remote areas and city centres alike.

"I'm very excited about the results of this project. It provides a good basis on which to evaluate the model. Now all we need is the political will to create the services that need to be there."

Brauer and her colleagues are planning a number of conference presentations on the successes of the pilot project and will include a supplement to the *Canadian Journal of Dietetic Practice and Research* this fall. Several peer-reviewed articles are also in the works.

Other collaborators involved in the project were Linda Dietrich, regional executive director of Dietitians of Canada in Toronto, and Julia Witt, Melbourne Institute of Economic and Social Research.

The project was funded by the Ontario Primary Health Care Transition Fund. 

Prof. Paula Brauer, Department of Family Relations and Applied Nutrition, says Canada's primary health-care system is changing to include dietitians on the front lines, to help with early and diagnostic health management.



Taking a load off

New food science technologies could reduce cell stress

By Alicia Roberts

People with chronic fatigue syndrome (CFS), a degenerative disease that attacks cells in the small intestine, may soon get help from small protein particles called phosphopeptides found in milk and eggs.

Prof. Yoshinori Mine of the Department of Food Science is leading researchers in using advanced food technologies to hone in on the ability of a particular peptide to reduce degenerative diseases such as CFS.

Mine says certain peptides in foods may react with genes in the body to reduce the stress on cells, warding off degeneration. Typically these peptides are inactive, but when they're digested in the body or exposed to enzymes in the lab, they become active and can have various functions, he says. They can be antioxidants, reduce

hypertension, influence immunity and have hormone-like functions.

"We're looking at food not just as a way to satisfy an appetite or for traditional nutrients," he says. "We're looking at how such bioactive peptides are released from foods and how certain components of foods react with genes to bring out specific health benefits."

Mine says degenerative health problems such as CFS are caused by stress. Through the human body's natural processes, this stress develops in cells. That makes them unstable, leads to degradation and accelerated aging and complicates various chronic diseases.

Normally, cells can detoxify themselves with a built-in antioxidant called glutathione (GSH). But when factors such as excessive alcohol consumption and smoking enter the picture, GSH is less effective. That leads to degenerative health problems.

Mine and his team have found that a peptide in eggs and milk has the ability to help reduce the stress load. They're studying its interactions through two food science approaches: nutrigenomics and proteomics.

The nutrigenomic approach helps the team understand the peptide's interactions at a genetic level. So far, they've found it can influence a specific gene to synthesize GSH, ultimately helping to fight stress. Mine says he's now trying to understand how and why this occurs.

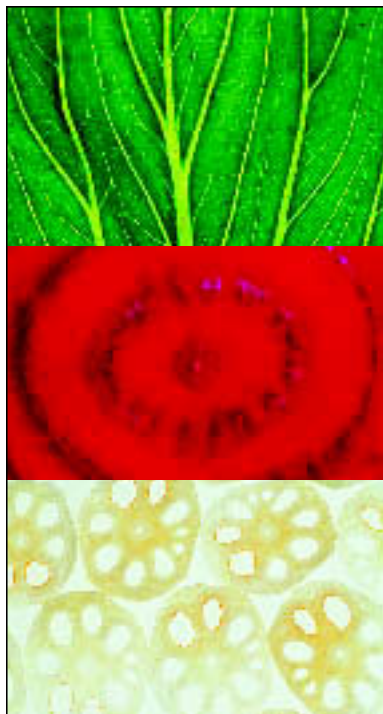
In the proteomic approach, the focus is on the specific characteristics of the peptide and why it has the ability to react with genes.

The team is studying pigs with CFS to learn more about the peptide's effects on cellular stress. Through tissue and blood samples, the researchers can compare the peptide's influence.

Mine's goal is to better understand why people have CFS, to improve diagnosis and to offer preventive and treatment measures using the peptide. He says the peptide could be used in developing specific health foods with anti-oxidative stress qualities or to make supplements that could help expel stress.

This research is part of an interdisciplinary approach involving research knowledge from across Canada through the Advanced Foods and Materials Network. It brings together researchers to combine and compare knowledge to study various aspects of food and biomaterials. Natural scientists, engineers, health researchers, social scientists and many other professionals are involved in the network, which is headquartered in Guelph.

Also involved in this research are U of G professors Ming Fan of the Department of Animal and Poultry Science and Gordon Kirby of the Department of Biomedical Sciences, University of Toronto nutritional scientist Ahmed El Sohemy and Rong Cao of Agriculture and Agri-Food Canada. ■



The Advanced Foods and Materials Network (AFMNet)

Building a healthier Canada

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- Developing wound dressings capable of releasing healing compounds to the affected tissue.
- Evaluating the bioactive compounds in human milk.
- Determining the beneficial effects of fish nutrients on the obesity-linked metabolic syndrome and cardiovascular risk profile.
- Characterizing plant-derived proteins and carbohydrates to improve frozen food quality.
- Making an entirely new, lower-cost antibiotic from plant materials for use in everything from pharmaceuticals to natural food preservatives.
- Looking at the Perceptions and Impact of Canada's Natural Health Product Regulations.

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Labels that make sense

Federal guidelines take guesswork out of nutritional value

By Jonathan Chambers



Food products in Canada sport new nutrition labels that will be easier to understand and compare using the standardized table that lists amounts of the 13 core nutrients as well as calories.

Knowing the nutritional content of what you're eating has been made easier by new nutrition labelling regulations developed by Health Canada. As of last December, most food products sold in Canada require a label that displays a standardized table listing amounts of the 13 core nutrients as well as calories.

This means consumers no longer have to deal with labelling that is selective or difficult to understand. If they know how to read one label, they'll know how to read them all. That should make it easier to compare products, manage special diets and control the intake of specific nutrients.

"Everything is in the same format, so people can pick up any product and see what they're eating," says Judy Stuart, senior applied research scientist at the Guelph Food Technology Centre.

The 13 nutrients that must be listed in the table are fat, saturated fat, trans fat, cholesterol, sodium, carbohydrates, fibre, sugar, protein, vitamin A, vitamin C, calcium and iron. Besides

the specific quantity, the percentage of the recommended daily intake for some nutrients must also be listed, based on the stated serving size. Excluded from the requirements are fresh foods such as fruits, vegetables and raw meat, as well as products such as water that have insignificant amounts of the 13 core nutrients.

Stuart says consumers should be aware that, despite the regulations, all labels won't look the same. If the amounts of seven or more of the 13 nutrients are zero, then a simplified table can be used. This table lists calories and amounts of fat, carbohydrate and protein plus any non-zero nutrient, and includes the statement "not a significant source of" the other nutrients.

Several optional nutrients may also be listed, such as potassium, zinc and omega-6 fatty acids.

Food manufacturers may choose to include nutritional and health claims on their product. Nutritional claims state the relative amount of a nutrient (such as high or low), whereas health

claims associate a diet containing high or low amounts of a particular nutrient with a possible reduction in the risk of a disease. (An example of a health claim is: "A healthy diet containing foods high in potassium and low in sodium may reduce the risk of high blood pressure, a risk factor for stroke and heart disease.")

Both types of claims are subject to strict nutritional requirements in the food, and exact wording must be used.

Stuart notes that although the table provides good information, it's up to the consumer to make a healthy choice. People are still responsible for knowing which nutrients they need to consume more of and which they should not overindulge in, she says.

For more information about nutrition labelling, visit: http://www.hc-sc.gc.ca/fn-an/label-etiquet/nutrition/index_e.html. ■

ds are causing real problems

Elevated instances of heart disease, hypertension, gall bladder disease, type 2 diabetes and some cancers are among the serious health risks associated with being overweight and obese.

Winson argues that one of the leading causes of the alarming rise in these health problems is the dominance of “pseudo foods” in the marketplace. He uses the term to encompass what is popularly considered “junk food” — candy bars and salty snacks — but also any high-calorie and high-fat foods and beverages that have low nutritional value. This includes anything that

lists sugar or fat as its first ingredient, such as certain fruit beverages, soft drinks, ice cream treats and presweetened breakfast cereals.

“Junk food is convenient,” says Winson. “People are urged to snack 24 hours a day by powerful ad campaigns of junk food and beverage corporations, yet they are getting heavier and don’t understand why.”

He says retailers are also accountable for this easy access to unhealthy foods. Pseudo foods command more profit for retailers, which explains their prominence in the supermarket.

Winson’s study of grocery stores found that considerable shelf space is devoted to pseudo foods, and “differential profits” determine product location in stores. Low-profit commodity items such as milk and eggs end up in the back of the store, requiring shoppers to walk past disturbing numbers of flashy displays and aisles of pseudo foods to get the essentials, he says. That greatly increases the chance that some of these higher-profit items will also end up in their cart.

He notes that profit is also a driving factor behind the easy availability of pseudo foods in the Kitchener-Waterloo, Cambridge and Guelph high schools he surveyed. Education cutbacks have forced schools to seek their own funding, and most have used vending machines or school cafeterias as a way to get more dollars from their students’ pockets.

Soft drinks, industrial baked goods (cookies, muffins, etc.), high-sugar snacks and high-fat foods such as french fries are the most commonly sold items in the schools he surveyed. Most cafeterias reported that they sell only four or five pieces of fruit per week. This offers some insight into why the number of overweight children and adolescents has nearly doubled and tripled over the past two decades.

Winson found that one high school had already taken steps to alleviate this problem by banning soft drinks and replacing them with healthier items. A few other schools were making an effort to provide healthier cafeteria fare. But he believes it will take more to really curb rising obesity among young people.

“Society needs to invest massively in effective education to shift people’s attitudes about unhealthy eating,” he says. “And we need to move quickly and pretty aggressively.”

Also involved in this project were students Maxine Fung, Christopher Valiquet and Rebecca Stranberg. Funding was provided by the University’s research assistantship program. ■



Kyle Rodriguez

“Foodscapes” dominated by low-nutrition, high-calorie foods are in part responsible for the North American obesity epidemic, says University of Guelph sociology professor Tony Winson.

Pseudo food consumers

By Jennifer Christie

Location, location, location. The key to a lucrative business or real estate sale may also be the cause of Canadians' expanding waistlines, says a University of Guelph researcher who's been studying the link between the food landscape or "foodscape" and Canada's obesity epidemic.

Prof. Tony Winson, Sociology and Anthropology, says a foodscape is any physical location where consumers buy or consume food. Looking specifically at supermarkets and public high schools in the Kitchener-Waterloo,

Cambridge and Guelph, Ont., area, he is finding that much of the food that's readily available in these environments is a direct contributor to the increasingly unhealthy diets of Canadians.

"There are massive amounts of low-nutrition food everywhere," he says. "There needs to be a realization that the health outcomes of poor eating are so horrendous that they will overwhelm us if not taken under control."

These outcomes stretch far beyond the obesity issue itself, which the World Health Organization has called a "global epidemic."





Fruits such as these held by Prof. Gopi Paliyath may contain compounds to help prevent and reduce the growth of cancer cells.

Kyle Rodriguez

The key to prevention

Cancer incidence may be reduced by eating common fruits

By Brian Innes

“Let food be thy medicine and medicine be thy food,” said Hippocrates, the father of ancient medicine. Today, research at the University of Guelph supports what was said more than 2,000 years ago: Food such as fruit is good food and good medicine. In fact, Canada’s fruit crops may contain compounds to help prevent breast cancer cells from forming.

Prof. Gopi Paliyath, Plant Agriculture, has used compounds contained in grape extracts to reduce the growth of cancer cells. He says they’re also effective in reducing certain breast cancer cell growth in mouse models.

“Increased fruit and vegetable intake has long been known to reduce the risk of developing cancer, but now we’re seeing the power of fruit extracts to help stop cancer cells from growing.”

Paliyath’s research has focused on the effects of flavonoid compounds contained in grapes and other fruits on cancer cells. Flavonoids are the brightly coloured plant pigments found in fruits and vegetables.

Preliminary tests have been encouraging, he says. In laboratory trials, flavonoids extracted from grape juice and wine have shown free-radical scavenging capacities similar to those found in well-known antioxidants vitamins C and E.

Antioxidants are important in cancer prevention because they absorb naturally occurring free radicals that are responsible for the genetic mutations that cause cancer to form.

Paliyath’s research has looked at the antioxidant ability of extracts from grapes and cherries. Identifying specific compounds that are the

most effective antioxidants — and finding out what fruits and vegetables contain them — is the first step in delivering food that has improved disease prevention properties, he says.

“The success of experiments done in vitro has been very promising.”

Trials are under way to see if the same benefits of these compounds persist in live animals. If the trials are successful, Paliyath plans to select the trees or plants that produce fruit with the highest flavonoid content to promote fruit consumption.

This research is sponsored by the Natural Sciences and Engineering Research Council and the Breast Cancer Society of Canada. 

Kick the caffeine, not the coffee

By Katie Cheesmond

Coffee is a morning “must” for many, but new research suggests we should fill our cups with decaffeinated java for better health.

Prof. Terry Graham of the Department of Human Health and Nutritional Sciences says caffeine, a component of coffee, reduces insulin’s effectiveness in humans. But he does acknowledge that coffee has a number of benefits, most notably its antioxidant properties.

So he has a suggestion: go decaf.

“Decaffeinated coffee provides the best of both worlds,” says Graham. “It gives you the benefits of coffee without the health concerns of caffeine.”

Reduced insulin effectiveness is a worrying finding for those who already have compromised insulin systems, such as obese people and those diagnosed with type 2 diabetes. Recently, there’s been a dramatic rise in the number of consumable products with high caffeine levels. Some energy drinks, for example, contain up to 80 milligrams of caffeine per eight ounces. Some brands of caffeinated water contain 100 mg (“lite” variety) or 200 mg (“extreme”) per

16-ounce bottle. Compare that with the average cup of coffee, which has 65 to 135 mg of caffeine, depending on strength and style of brewing.

Health Canada suggests that the general population of healthy adults consume no more than 400 to 450 mg of caffeine per day, the equivalent of about three cups of coffee. The problem with energy drinks is that many people don’t realize how much caffeine they’re consuming, Graham says.

He notes that the effects of consuming caffeine in the morning compound as the day goes on. His research found that caffeinated coffee consumed at breakfast had drastic effects on insulin levels produced after lunch. The elevated insulin level caused by breakfast lingered, not returning to the person’s normal resting level before the second meal was consumed. This effect was found in all subjects, but was more prolific in those exhibiting insulin resistance.

“The most surprising results of all were the great increases in insulin levels that were seen after the second meal was consumed,” says

Graham. “The results were more dramatic than we had expected.”

Caffeinated coffee is not the only exotic component of consumer diets that is worrisome, he adds. An extract similar to caffeine from the South American guarana bean is making its way into consumer products and growing in popularity because of unproven claims that it can aid in weight loss. Guarana beans contain about three times more caffeine than coffee beans do, says Graham, and the extract is being used in a variety of beverages. Although many of these products are currently limited to the U.S. market, some are making their way into Canada, he says, and consumers should be aware of their effects.

Collaborators in this project include Prof. Lindsay Robinson and graduate students Danielle Battram, Lesley Moisey and Sita Kacker, Department of Human Health and Nutritional Sciences. Funding was provided by the Natural Sciences and Engineering Research Council of Canada. ■



Kick the caffeine and opt for decaffeinated java the next time you fill up. A Guelph researcher says it's the best route to get the benefits of coffee without the health concerns of caffeine.

'Trans' Canada

As a country, we are eating too much bad fat, says researcher

By Katie Savage and Alicia Roberts

Canadians consume more trans fats

than people in most other countries do — as much as 20 grams a day. Although ingesting trans fats won't kill a person instantly, says Prof. Bruce Holub of the Department of Human Health and Nutritional Sciences, a steady diet of them can cause serious health problems, including premature heart disease.

Holub, who's studied trans fats and their health risks for 28 years, says eating partially hydrogenated oils, particularly in fast foods, has resulted in high daily trans fat intakes for Canadians.

"Our diets, as typically consumed, don't provide for healthy eating," he says. "They contain a heavy intake of partially hydrogenated soybean and canola oils in foods that have been labelled 'cholesterol-free' or 'low in saturated fat,' implying that they're safe to eat but not showing the whole picture."

Most trans fats are unnatural unsaturated fats. They're created through a process called hydrogenation that chemically converts plant-based oils to solid or semi-solid fats. The technique is widely used by food manufacturers to increase a fat's melting point and shelf life, making it better suited for baking and food processing. But hydrogenation can raise the trans fat content of a solidified oil to the point that it

constitutes 40 to 50 per cent of the total fat content.

Holub says a whopping 90 per cent of the trans fats we consume come from various processed and fast foods cooked or made with partially hydrogenated oils. Numerous snack foods and breaded chicken and fish are particularly laden with trans fats in this way.

The other 10 per cent of trans fats come naturally through products from ruminant animals such as dairy and beef cattle. These animals have tiny organisms called microflora in their gut that convert natural unsaturated fat from the food they ingest to trans fats, which they pass on through milk and beef products in small amounts.

Trans fats increase the amount of "bad" (low-density lipoprotein or LDL) cholesterol in the blood, while decreasing the amount of "good" (high-density lipoprotein or HDL) cholesterol, says Holub. The bad cholesterol winds through the circulatory system and can block passages in the heart. Other major health concerns related to trans fats include increased risk for type 2 diabetes. In pregnant women, consuming foods high in trans fat can compromise the amount of essential omega-3 fatty acids passed to the infant in the womb and through breastfeeding.

The Canadian government has already taken

steps to reduce trans fat consumption by introducing mandatory labelling on products. Under the new rules, a food product can be called trans fat-free, but only if it contains less than 0.2 grams of trans fats per serving.

Although high-trans fat products still exist, more companies are lowering the trans fat content of their products and using it as a marketing tool, says Holub.

Ottawa has also created a task force to make recommendations on how to lower trans fats in certain foods. One year into its mandate, the task force is advising a limit on trans fat content as a percentage of the total fat in margarine, processed foods and fast foods.

"We're always looking to improve the methodology and measuring tools for trans fats," says Holub. "We've got a good start, but there's still a long way to go. A complete ban on the production of industrial trans fats would dramatically reduce our intake of these harmful fats." ■

Foods made with partially hydrogenated oils contribute a whopping 90 per cent of the trans fats we consume and can lead to serious health problems, says a Guelph human health and nutritional scientist.





Functional foods: Therapy for the health-care system

By Robert Godin

Functional foods — food products that offer health benefits beyond basic human nutrition — can help Ontarians' health and the Ontario budget.

So says John Kelly, executive director of MaRS Landing, an organization linking agriculture, food and human health through research and product development in the province.

"Functional foods have an opportunity to make a dent in the Ontario budget," says Kelly, who notes that more than 50 per cent of provincial tax dollars are spent on the health system. That figure could be reduced with functional foods, a preventive approach to health care, he says.

Research is under way at many places, including the University of Guelph, to enhance food products. For example, Guelph researchers enhanced milk with an omega-3 fatty acid called docosahexaenoic acid (DHA) by feeding

cows a proprietary mixture that included fish meal. Once consumed, the DHA naturally found in the fish meal gets passed to the cows' milk. DHA helps prevent cardiovascular disease and improves brain function, among other health benefits. This technology development led to the Dairy Oh! brand of milk now found at the grocery store.

Kelly says markets are cropping up for food products that yield positive health effects. They sell for premium prices, but unlike what happens with many value-added products, functional food premiums can be spread throughout the food value chain from producer to consumer, so that everyone shares in the financial profits and consumers get the health benefits.

Identifying functional foods is much less of a problem than labelling them. The regulatory process that oversees health claims on products isn't well understood and can be long and diffi-

cult, says Kelly. In fact, it can be a deterrent to encouraging new functional food development.

"We have to ensure that regulations don't take away competitiveness or stifle innovation," he says.

Although Canada's regulations allow only the safest products to hit grocery shelves, the approval process is the longest among all major developed nations, says Kelly. It's important that only the safest products reach consumers, he says, but a painfully slow regulatory process can hurt the country's competitiveness. Competitors are able to release products sooner into the marketplace, putting Canadian producers at a disadvantage long before their products hit the market. That's contrary to what it takes to improve Ontarians' health and optimize health-care spending, he says. ■

Functional foods, those that offer health benefits beyond basic human nutrition, are catching the eye of consumers.

MaRS Landing: Accelerating technology development and commercialization

By Kim Waalderbos

The health and agri-food innovation communities are being helped by a Guelph-based group to combine resources so new technologies and research can be brought to the marketplace.

MaRS Landing links innovators from rural Ontario with those in the Discovery District in downtown Toronto. The Discovery District houses Toronto's best in science and business, including university and hospital professionals, all in one area. The linkage of agriculture and food to the

health sector has substantial benefits for the economy.

John Kelly, executive director of MaRS Landing, says the connections enable experts to optimize facilities and resources to improve capabilities of their own organization; give greater access to legal, financial and regulatory assistance; and facilitate communication and research collaborations.

MaRS Landing is a joint project of the University of Guelph, the City of Guelph, Ontario Agri-Food Technologies and the MaRS Discovery District in Toronto. Funding has been provided in part by Agriculture and Agri-Food Canada and the Ontario Ministry of Agriculture, Food and Rural Affairs under the Agricultural Policy Framework, an agreement among federal, provincial and territorial governments to make Canada's agricultural sector a world leader in science and innovation. The office is housed in the U of G Research Park.

Omega-3 chicken about to hatch

Poultry meat enriched with flax and fish oil diets offers extra health benefits

By Arthur Churchyard

The egg may have come first for omega-3-enriched poultry products, but now the chicken isn't far behind.

Prof. Steve Leeson of the University of Guelph's Department of Animal and Poultry Science has already enriched eggs with omega-3 fatty acids and is now leading an effort to do the same with poultry meat. He's identifying various poultry feed combinations that can be fed to chickens to add heart-healthy fatty acids to the animals' meat, while also keeping it tasty.

"We've shown it's possible to feed poultry omega-3 fatty acids and have the nutrients expressed in the meat," says Leeson. "Now our challenge is to help farmers produce this enriched meat efficiently, while maintaining quality taste."

He's found that poultry become sufficiently enriched with omega-3 fatty acids after 10 to 14 days on a flaxseed diet. At this stage, the nutrients build up in the body fat and, once present, are constantly reused in cycles for growth and energy.

One of the omega-3 fatty acids stored in the fat layer is docosahexaenoic acid (DHA). Leeson calls DHA the "super fat" because of its many health benefits. DHA is known to improve human visual and learning abilities, boost immune function and relieve symptoms of some psychological disorders and inflammatory diseases.

Until now, the only way to get enough DHA was to consume a diet rich in oily fish. Researchers found that adding fish oil to poultry feed gives humans who consume the poultry an alternative DHA source.

Leeson predicts a market for nutrient-enhanced poultry meat in sales of whole chickens (the kind used for roasting). Unlike most meat cuts, which are too lean to store enough fatty acids, whole chickens contain much of the original fat content, which is where DHA and other omega-3 fatty acids are stored.

Whether or not consumers notice a difference in taste remains to be seen. Because the highest DHA concentrations are found in fish, some people characterize the enriched meat flavour as "fishy." Leeson is now balancing the amount of omega-3 and DHA fatty acids in the enriched meat to make sure its enhanced nutritive quality doesn't interfere with taste.

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

Ontario Farm Animal Council



Chickens could help bring beneficial omega-3 nutrients to a table near you.

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LET'S START HERE

A dual reflection on health and nature

Researchers at the University of Guelph have a lot to say about health and they have a lot to say about nature. And so they should. Health and nature — or well-being and the environment — are heady words. They embrace a broad spectrum of things that matter most to people, such as minimizing the likelihood or impact of adverse health, or doing things that help us understand and take care of the world around us. In so many ways, these words are also intimately linked.



Alan Wildeman

The Roman god Janus had a double-faced head, with each face looking outward in opposite directions. He was noted as being the god of gates and doors, the god of beginnings and endings. He was heralded at important transitions in people's lives when they reflect on the past and look forward, such as harvest time, marriage and birth. He also came to represent the transition between primitive living and civility, between rural and city life, between war and peace, and between youth and age. While each member of these various dualities is distinctive from its partner, they are all different faces of the same existence.

This issue of the University of Guelph's *Research* magazine is a dual reflection on health and nature. From one side, you will read about what Guelph researchers are doing to learn more about the nature of health. From cancer research to studies of infectious diseases and animal health, new discoveries are being made about the mechanisms underlying diseases and new research on how to stay healthy is under way. From the other side, you will read about health and nature. You will find stories about research being done to help us understand the natural world around us, and how the health of that world and our own health are linked.

The format is in the tradition of Janus, because when we use the word health, there are literally at least two sides to every story. This is not two issues of the *Research* magazine merely stapled together. Rather, this issue provides you with two perspectives on health and the world we live in and on research being done at the University of Guelph to help us understand their relationships.

Each of us in our lifetime will deal with transitions in health and nature. At our university, there is a history of doing things that are relevant to the health and well-being of people, communities and the environment. This issue highlights how, in a world with more people than ever before and an environment under greater stress, this tradition is continuing through world-class research that becomes more relevant and needed with each passing year.



Alan Wildeman
Vice-President (Research)



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*Epilepsy research bonds
Prof. Roberto Poma and
his teaching assistant
dog, Salsa, at the Ontario
Veterinary College.
See page 31.*

INSIDE: PSEUDO FOODS • KICKING CAFFEINE • CURBING OBESITY