

# GOOD FOOD

# BETTER HEALTH

Summer 2005



## GROWING UP GREEN...AND RED

Healthy Hearts, Healthy Minds program promotes good eating habits in Ontario children. *See page 8*

INSIDE: A bean for better health • Milk controls appetite • Will customers embrace food technology?

# Implementing the science of food for health delivery



by Dr. Gord Surgeoner  
President, Ontario Agri-Food  
Technologies

It's clear food has a central role in public health. But more and more, important questions need to be answered about food policy.

Food and health are inextricably linked. Vitamin C in fresh fruit prevents scurvy, iodine in salt fights goiter, and we're always learning about how food that's long been a part of our diet – such as tomatoes – can help fight cancer. In recent times, the mandatory introduction of folic acid into grain products in Canada has led to a 58 per cent reduction of neural tube birth defects (spina bifida) and 62 per cent fewer cases of neuroblastoma, a pediatric cancer.

Unfortunately, however, the abundance of food, and poor food choices, is causing problems everywhere. The burgeoning obesity epidemic – which can



lead to type 2 diabetes, osteoporosis and increased heart disease risk – is caused by consuming too much food relative to physical activity.

From a food policy perspective, this situation raises many issues:

- How do we encourage change in Canadians' eating habits?
- Can public policy initiatives, such as removing "junk food" from schools, be successful?
- How is scientific knowledge about food applied to public health policy?



- Who pays for expensive clinical trials for food products used for health treatments, when there's only a slim chance of intellectual property protection?
- How do we allow some form of exclusivity to food companies – as we do with drug companies – to encourage private sector research and marketing?
- Can our regulatory system change to allow health claims for specific foods?

We need to support research excellence in both the Canadian public sector and the nation's food companies. This, along with addressing policy-related questions and issues, will help implement positive results for Canada's consumers. ☺

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*Good Food, Better Health* is designed to build awareness and understanding of the province's agri-food research activities and accomplishments, sponsored by the Ontario Ministry of Agriculture and Food, in determining the links among sound diets, high-quality food and public health.

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# Drink milk, control hunger

## Two key milk proteins may help North America battle the bulge

KIM WAALDERBOS

Expanding waistlines may best be controlled with a glass of milk, say University of Toronto researchers. That could be good news for the 60 per cent of North Americans who are considered overweight or obese.

Studies have shown a positive relationship between the consumption of dairy products and ideal body weight. Milk has also been found to be effective in high-protein weight-loss diets. But Prof. Harvey Anderson and research associate France Cho of the Department of Nutritional Sciences say it's not necessarily the high protein in diets that benefits human health but rather selecting for the right proteins.

The researchers are studying how specific food proteins affect intake and reduce hunger in humans and rats. They believe certain milk proteins such as whey and casein may be particularly beneficial in helping consumers feel full and satisfied, staving off the desire to eat more.

"Milk is very well-designed to give a quick feeling of satiety," says Anderson. "It contains those two key proteins, which strongly suppress hunger."

The researchers' study group consisted of young men who ate complete milk, soy and egg proteins, as well as casein and whey (both derived from milk). The researchers found that complete milk and whey protein had the strongest ability to suppress the men's desire to eat within the following 90 and 150 minutes. Casein was also effective, but it didn't provide such immediate satiation.

Anderson and Cho say their findings can be used to develop functional foods, products that are enhanced to offer health benefits beyond their basic nutrition. They foresee whey and casein proteins of milk being incorporated into other foods to make use of these beneficial properties. Whey, a byproduct of cheese making, is readily available for such purposes. This could ultimately add new products to the market to help consumers with weight control.

Until new products are developed, however, Anderson says people concerned about their weight and wanting satiation should increase their milk consumption.

"The best thing a hungry person could do after a long day is to have a big glass of milk to tide them over until supper."

This research is funded by a Bristol-Myers Squibb Freedom to Discover Grant, the Ontario Ministry of Agriculture and Food, and Science and Engineering Research Canada.

Others involved in this research include graduate students Alfred Aziz, Alireza Jahanmihan, Shannon Moore and Sharon Peng. ☺

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Paula Blaiski

Complete milk protein and milk-derived whey protein can temporarily suppress hunger, making it an ideal after-school or after-work snack, say University of Toronto researchers.

# Soy: A bean for

## Scientists look to develop high-isoflavone soybeans

MURRAY TONG

Soybeans have many health and nutritional benefits. They're high in protein and fibre, low in saturated fat, and they contain omega-3 fatty acids and isoflavones, making them unique among oilseeds. Naturally occurring isoflavones have been shown to lower the incidence of cancer, cardiovascular disease and osteoporosis. They also improve prostate health in men and help post-menopausal women manage hormonal changes.

Now, University of Guelph researchers are breeding higher isoflavone levels in soybean cultivars while maintaining characteristics farmers want, such as high yield and uniform maturity.

"A soybean with higher levels of isoflavones will be of great benefit to the industry," says University of Guelph plant agriculture professor Istvan Rajcan, one of many researchers looking at enhancing isoflavone levels. "Now that we understand how isoflavones are genetically controlled, we have completed the first step in developing a healthier soybean."

He and former graduate student Valerio Primomo recently mapped the soybean genes responsible for isoflavone content. Now, Rajcan is using this information to study the isoflavone trait and develop new soybean breeds from a series of hybrid crosses. The researchers are currently testing the ninth generation of high-, intermediate- and low-isoflavone soybeans to see how well these varieties do in the field.

Preliminary results are encouraging. Rajcan and his group have found that high-isoflavone soybeans tend to have higher yields, too. In some plant populations, however, these high-yielding varieties tend to be late-maturing, which could be a problem if Ontario experiences a short growing season. So the researchers are also developing early maturing soybean varieties without sacrificing yield or isoflavone content.

Martin Schwalbe



In their genetic studies, they've used two University of Guelph soybean varieties called OAC Arthur and RCAT Angora, which are especially rich in isoflavones and have nearly all the agronomic characteristics the researchers are looking for, including a yellow hilum, the thin scar on the bean where it's attached to the pod. The hilum can take on various shades of brown, black or beige, but the lighter yellow colour is most suitable for food production because dark hilums can discolour food products.

"Having a yellow hilum as opposed to a brown one doesn't seem like a big deal," says Rajcan, "but it creates more opportunities for the soybeans because they can be used for any of the major soy products, such as miso, tofu and soy milk."

He's collaborating with Prof. Alison Duncan, Human Biology and Nutritional Sciences; Prof. John Cranfield, Agricultural Economics and Business; Prof. Massimo Marcone, Food Science; Rong Cao, Agriculture and Agri-Food Canada; and Al Mussell, George Morris Centre. Together, they're working to incorporate soy into bread, which would make the myriad health benefits of isoflavones more widely available (see opposite page for story).

This research has been funded by First Line Seeds, the Ontario Soybean Growers, the Hensall District Co-op, Hyland Seeds, the Potash and Phosphate Institute of Canada, the Canadian Fertilizer Institute and the food research program of the Ontario Ministry of Agriculture and Food. 🌱

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# better health



University of Guelph Prof. Istvan Rajcan has found that soybean varieties high in isoflavones – naturally occurring compounds that can lower risk of cancer, cardiovascular disease and osteoporosis – also tend to have high yields.

## New research puts functional soy component right in the breadbasket

ALICIA ROBERTS

Soy has rapidly risen to the top of the functional food chain, largely because of its high level of isoflavones, compounds that help reduce the risk of heart disease and certain types of cancers. Despite this benefit, many people are put off by soy's distinctive taste, which keeps them from enjoying its health advantages.

Enter Prof. Alison Duncan of the University of Guelph's Department of Human Biology and Nutritional Sciences. She has assembled a team of researchers to bring soy's health benefits beyond soy foods, by incorporating isoflavones into everyday staple foods. They're starting with isoflavone-enriched bread.

"We want to introduce newly developed foods that would provide consumers with more options to increase their intake of soy isoflavones," says Duncan.

The project has four phases. First, she and her team will grow and harvest soybean plants with low, medium and high isoflavone levels. Next, they'll use the soybeans to produce breads with the three different levels. Third, they'll monitor human subjects as they consume the breads to evaluate how well the isoflavones are absorbed into the body. Finally, the team will conduct economic and consumer choice evaluations to gauge the public's interest in this kind of isoflavone-enhanced product and to see if it's economically viable.

Duncan says this study is unique because it involves researchers in plant agriculture, food product development, nutritional science, natural product chemistry and agricultural economics.

"One of the most exciting parts of the project is that it brings different disciplines together," she says. "We're all interested in soybeans in some way, but each from a different standpoint. In working together, we create an interesting approach to our research."

The team aims to complete its studies by 2008.

Duncan is collaborating with Prof. Istvan Rajcan, Plant Agriculture; Prof. Massimo Marcone, Food Science; Rong Cao, Agriculture and Agri-Food Canada; Prof. John Cranfield, Agricultural Economics and Business; and Al Mussell, George Morris Centre. Their work is funded by the food research program of the Ontario Ministry of Agriculture and Food. ☺

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Everyday foods such as bread could soon be enriched with health-enhancing soy components, thanks to collaborative research at the University of Guelph.



Martin Schwalbe

# The road to bran's untapped potential

## From nutraceuticals to oil production, bran byproducts have many uses

KATHARINE FOUND

Ontario produces an average of 350 tonnes of wheat bran each day, but only a small portion is used to increase fibre content in foods. This leaves a huge quantity that has little use.

Enter Dr. Steve Cui of Agriculture and Agri-Food Canada (AAFC), who is trying to find new uses for this agricultural byproduct and is studying technologies he believes could add health benefits and nutritional value to food, as well as contribute to environmentally friendly practices in a variety of industries.

“There’s so much bran that can’t be used right now,” he says. “This research will have broad benefits.”

Wheat bran is composed of starch, soluble and insoluble fibre, protein and a variety of minor components such as phenolic compounds. Once extracted and purified, each component can be marketed individually, significantly increasing wheat bran’s value, says Cui.

For example, starch and non-starch polysaccharides can be isolated from the bran. The non-starch polysaccharides can be further separated into individual polysaccharides that have special nutritional and food modification properties, such as arabinoxylan (commonly known as pentosans) and beta-glucan. Arabinoxylan could increase the shelf life of baked goods and other food products; cereal beta-glucans are effective nutraceuticals that can lower cholesterol and control blood glucose levels.

In addition, these extracted polysaccharides are high-viscosity materials with potential applications in other industries, says Cui. The oil drilling industry, for example, can use them to suspend the dust that’s produced during drilling and increase pressure in the well, improving oil production efficiency.

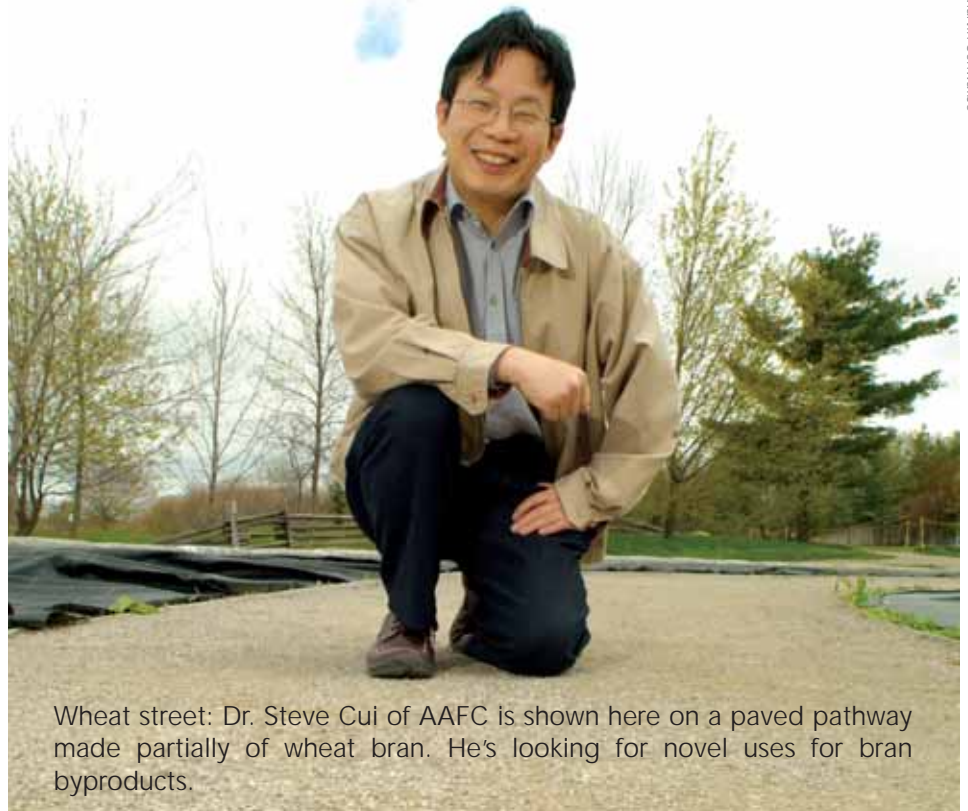
The extraction process also yields phenolic compounds, which have antioxidant functions and promote fat metabolism. With more studies emerging about oxidative damage in the body, this presents significant human health benefits, he says.

Even the landscape industry is finding wheat bran byproducts useful for their binding potential. Currently, synthetic chemical binders are used for paving, which can lead to environmental contamination. Biodegradable and environmentally friendly products composed of wheat bran compounds could be used as a replacement. These binders have no toxic properties, says Cui.

The remaining compounds from the extraction process are cellulose and lignins, which can be used as filling material for hardboard products and packaging.

Cui, who’s collaborating with AAFC colleagues and University of Guelph food science professor Yukio Kakuda, is in the second year of this three-year research project. It has been sponsored by Hayhoe Mills Ltd., the Ontario Ministry of Agriculture and Food and AAFC. ☺

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Wheat street: Dr. Steve Cui of AAFC is shown here on a paved pathway made partially of wheat bran. He’s looking for novel uses for bran byproducts.

Martin Schwalbe

# Fitting more fibre into food

## The hunt is on for heart-healthy soluble fibre in Ontario's agricultural products

LAURA BURNETT

Soluble fibre's many health and nutritional benefits have long been recognized, but the real challenge for food scientists is finding ways to incorporate it into everyday diets.

University of Guelph food science professor Doug Goff is leading a research team to assess soluble fibre sources that could be added to a person's diet to improve health and nutrition. The researchers are also evaluating untapped soluble fibre sources produced from Ontario agricultural commodities such as soybeans and flaxseed.

"We hope to generate information that helps the food industry formulate foods rich in soluble fibre," says Goff.

Soluble fibre is just one example of a polysaccharide, a complex carbohydrate made up of multiple sugar compounds. It's naturally present in plant-derived products such as pectin, gums and mucilage. There's also soluble fibre in oats and various fruits and vegetables, but only in small amounts.

Soluble fibre intake has been linked to lower cholesterol and decreased risk of heart disease and cancer. Goff's research is designed to find ways to increase the concentration of soluble fibre in certain foods so consumers can experience the health benefits of ingesting more fibre.

Increasing dietary soluble fibre also means searching for it in foods that haven't been used for this purpose before, says Goff. For example, flaxseed gum is high in soluble fibre. During the milling of flaxseed, the hulls are removed and discarded, but it's been found that significant amounts of soluble fibre can be extracted from the hulls, adding value to that waste product.

The research project consists of four sub-projects, each involving University of Guelph food scientists. The first component, led by Goff, post-doctoral researcher Francois Capel and Steve Cui of Agriculture and Agri-Food Canada, is examining the molecular structure and functional properties of selected polysaccharides.

Prof. Douglas Dagleish and post-doctoral researcher Anneke Martin lead the second sub-project, which focuses on polysaccharides' interactions with protein. They want to determine how soluble fibre behaves in real food systems and whether fortification of different foods with soluble fibre would have a negative impact on food structure.



Adding more soluble fibre to foods would not only boost consumer health but also add value to agricultural waste products.

The third sub-project, headed by Prof. Milena Corredig and graduate student Ingrid Ayala-Hernandez, is centred on discovering more about polysaccharides generated from microbial origins. For example, some bacterial cultures used to make yogurt produce polysaccharides, and the researchers want to know if they have any functional and nutritional properties.

The research project's fourth component, which has yet to begin, will examine the sensory aspects of adding polysaccharides to foods. Dr. Chris Findlay of Compusense will lead this sub-project, which will evaluate how adding soluble fibre to food affects its taste, texture and other sensory properties.

Goff hopes the food industry will apply the data generated from this work to formulate soluble fibre-rich foods. He notes that farmers and consumers will also gain from this research. Finding novel uses for Ontario agricultural commodities — especially low-value products — benefits producers because most soluble fibre ingredients are currently imported. And consumers can experience the added health benefits of increasing their intake of soluble fibre.

"Although the food industry is the main user of this information, the consumer ultimately benefits," he says.

The four-year research project, which began last September, is funded by the Ontario Ministry of Agriculture and Food's food research program. ☺

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# Red, green and

## Student nutrition pilot program expands to bring healthier snacks to more Ontario classrooms

MURRAY TONG

Growing awareness of childhood obesity has raised the alarm for parents, health professionals and children themselves. Studies show the percentage of overweight children tripled in Canada between 1981 and 2002 to 25 per cent, with nearly half of them considered obese. With the Ontario government's October 2004 ban on junk food in elementary school vending machines, many students are looking for alternatives to satisfy those recess cravings.

That's where the Ontario Student Nutrition Program and the Ontario Greenhouse Vegetable Growers (OGVG) come in. They've teamed up with the Windsor-Essex and Toronto District School

boards to create a pilot school nutrition program called Healthy Hearts, Healthy Minds. The project will offer Ontario-grown greenhouse vegetables to elementary school children as snacks, giving them a midday nutritional boost that's healthier than the high-sugar or high-sodium snacks typically found in vending machines before the ban.

Healthy Hearts, Healthy Minds is currently operating in 10 schools in Windsor-Essex and six in Toronto, with plans to expand to up to 42 schools in the two district school boards during the next school year.

Jim Reynolds



Students from the Windsor-Essex District School board say thank you for the nutritious Ontario-grown tomatoes and cucumbers provided by the Healthy Hearts, Healthy Minds project.



# growing

“The most important goal here is to get children on the road to better health,” says Jim Reynolds, OGVG’s marketing co-ordinator.

The greenhouse produce — cherry tomatoes and mini-cucumbers — is washed, sliced and delivered directly to the schools by the growers and the OGVG. That makes it easy for teachers to distribute the snacks before recess.

The pilot project is especially well-suited to elementary schools because it gets young children eating fruits and vegetables regularly, says Stephanie Segave, regional co-ordinator for Windsor-Essex’s Ontario Student Nutrition Program. And that makes them more likely to develop good nutritional habits as they grow up, she says.

“Primary schools are a great place to start because studies have found that we can change eating patterns more easily to include nutritious food at a young age.”

What’s more, the classroom atmosphere is ideal for serving nutritious foods, says Segave. Children who may be reluctant to eat healthy snacks are influenced positively when they see their classmates enjoying them, she says. In fact, children with an initial aversion to the snacks even asked for seconds.

The Healthy Hearts, Healthy Minds pilot project is divided into two phases. The first, which ran from October 2004 to February 2005, evaluated existing snack programs for effectiveness, nutrition and economics. The programmers found that the province’s current nutrition programs, which are volunteer-run and typically serve snacks such as bagels and pretzels, are constrained by time and budgets and can’t always serve foods as nutritious as organizers would like.

Healthy Hearts, Healthy Minds, on the other hand, is easier for teachers and volunteers because the OGVG and participating greenhouse growers bring the snacks ready to serve right to the schools. The pilot also provides consistently healthier snacks. It does, however, come with a price tag. The average cost of providing greenhouse vegetables is 55 cents per child per day, whereas other nutrition programs can run as low as six cents.

The OGVG is currently buying the produce from its member growers and supplying it to schools free of charge, but Healthy Hearts, Healthy Minds administrators hope to obtain financial support from school boards as well as Ontario’s health and education ministries.

In the second phase of the project, which is currently under way, the OGVG and the Ontario Student Nutrition Program will look at the effectiveness of the Healthy Hearts, Healthy Minds pilot and whether it’s possible to take the program to a provincial level. University of Windsor PhD candidate Sherry Bergeron is conducting this study and will consider factors such as changes in students’ eating habits and changes to the schools’ nutritional and educational activities.

Although it’s still in the pilot phase, the OGVG and the Ontario Student Nutrition Program have big plans for Healthy Hearts, Healthy Minds. OGVG general manager Kristen Callow is looking for partners in other Ontario fruit and vegetable producer organizations to offer a wider variety of healthy snacks to classrooms. She hopes Healthy Hearts, Healthy Minds will eventually develop into a province-wide elementary school nutrition program that uses Ontario’s fruits and vegetables.

But in the end, says Segave, the success or failure of school nutrition programs depends largely on how much the children like the snacks. And in that department, Healthy Hearts, Healthy Minds is promising.

“The teachers have had fabulous feedback from the kids,” she says, recalling one Windsor classroom in particular. “We stop the fruit and vegetable deliveries over the winter holidays, but many of the children were asking their parents for the healthy snacks — especially the mini-cucumbers — every day of the break.” ☺

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# Battle of the breads

## Not all carbohydrates are created equal, say nutrition researchers

HILARY EDMONDSON

Multi-grain, 12-grain, whole-grain, flaxseed — the list of different types of bread available to consumers goes on and on. Still, no one knows exactly which type is the most healthy and why.

And with growing concerns about health, obesity and consumption, the Ontario Ministry of Agriculture and Food has developed new research priorities that stress multidisciplinary approaches to tackling health problems and improving the well-being of Canadians.

With that in mind, a team of researchers from various disciplines is looking at different types of bread and, more specifically, different types of carbohydrates to learn which help or hinder a person's health.

On the team are four members of the University of Guelph's Department of Human Biology and Nutritional Sciences — Profs. Arend Bonen, Alison Duncan, Terry Graham and Lindsay Robinson — Guelph food science professor Rickey Yada, University of Waterloo kinesiology professor Jim Rush and Phil Lee Wing of the Food Development Group in Richmond Hill, Ont.

The researchers have refined the traditional glucose tolerance test. Instead of giving study participants a pure high-glycemic (high in simple sugars) drink, they're providing bread with varying carbohydrate compositions to determine which types of carbs produce certain postprandial (after a meal) metabolic reactions that can affect blood sugar, insulin levels and even the functioning of blood vessels themselves.

Using clinical nutrition trials, the researchers want to determine the metabolic responses of obese subjects — among those at highest risk for type 2 diabetes and cardiovascular disease — to the quality or type of carbohydrate they ingest. They'll be looking at white, whole-grain, barley and sourdough bread in these studies.

"We hope to use this information to educate the public about how to make healthier food decisions and to send the message that not all carbohydrates are bad," says Robinson.

They're also working with the Food Development Group to design breads and carbohydrate mixtures for use in their human clinical trials. They hope the healthiest breads they develop can eventually be recommended to the food industry.

Carbohydrates have earned a bad reputation for causing weight gain, but the researchers say that foods with a high glycemic index, such as white bread, are the ones to be wary of. Although all breads are relatively healthy, the carbs in whole-grain breads, for example, have many more positive health benefits.

Foods with a high glycemic index are absorbed quickly into the bloodstream. The body reacts by releasing insulin into the blood to remove the excess glucose and control blood sugar levels. If the muscles and body keep seeing high insulin, they can become insulin-resistant, which can lead to type 2 diabetes.

On the other hand, low-glycemic index foods such as whole grains often contain more complex carbohydrates and release glucose into the blood at a slower rate. This results in blood sugar levels that are more constant, and the risk for diabetes is ultimately reduced.

This research is sponsored by the food research program at the Ontario Ministry of Agriculture and Food. ☺

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Paula Blaski

With dozens of breads available to consumers, Ontario researchers have teamed up to determine which breads have the most positive health benefits.



# Friendly fat

## Scientists draw the line between good and bad fats

HILARY EDMONDSON

Eating certain types of fat could help reduce your risk of disease, says a University of Guelph researcher. But it has to be the right type.

Prof. Lindsay Robinson, Human Biology and Nutritional Sciences, and her research team are developing fat tolerance tests to assess how individuals react to different fat types. They're studying how these fat types affect the body's metabolic activities.

"Fats can't be placed in just one category, because they don't all elicit the same response," she says. "Polyunsaturated fats, or 'good' fats, have been shown to reduce cholesterol and risks for type 2 diabetes and cardiovascular disease when you eat them as a substitute for 'bad' fats, like saturated fat."

Although traditional fat tolerance tests often lump all fat types into one category, Robinson wants to compare "good" and "bad" fats because they each create different metabolic responses. She's working with food scientists to design a shake-like drink containing selected natural fats, which can be used to test how humans metabolize different fats. After study participants ingest the drink, researchers can test fat levels in each subject's blood and the metabolic response that's associated with the fat in the drink.

Robinson says it's important to test different fat types separately to learn which are the most beneficial. Simply switching to corn, canola and olive oils can actually help reduce cholesterol and lower blood lipids, which can lead to improved health.

She's also interested in cytokines, hormone-like proteins that are involved in inflammatory responses. Cytokines, which are released from adipose (fat) tissue in the body, are believed to contribute to type 2 diabetes and cardiovascular disease, which means that people with excess adipose tissue could be at higher risk for those diseases.

The researchers are now testing to determine whether abnormally high cytokine levels result from fat ingestion and if the type of fat can alter this response. Abnormal metabolic responses to fat ingestion can occur many years before the actual onset of disease, making this information useful as an early biomarker of type 2 diabetes and cardiovascular disease.

One of their criteria for whether a fat is "good" or "bad" is how it affects cytokine levels, among other metabolic responses. If a certain fat type leads to increased cytokine release, it might be one people should avoid.

Eventually, the research group hopes to develop an oral fat tolerance test to rapidly assess Canadians' risk for type 2 diabetes and cardiovascular disease. Earlier risk detection means people will have more time to change their diet and lifestyle, helping to prevent these diseases.

Still, Robinson says prevention and awareness of "good" and "bad" fat consumption are key to a healthier public and lower disease risks. She and her team hope to learn more about the benefits of "good" fat and help the food industry incorporate these fats into everyday food products.

Collaborating on this research at U of G are Prof. Terry Graham, Human Biology and Nutritional Sciences; and Prof. Alejandro Marangoni and research associate Amanda Wright of the Department of Food Science. Also involved is University of Waterloo kinesiology professor Jim Rush.

This research was sponsored by the Ontario Ministry of Agriculture and Food as part of the FoodInnovation Network. ☺



Sarah Fischer

Lean meat with low amounts of saturated fat can be part of a healthy diet.

Good food and exercise work together to promote better health.



Paula Blanski

# Flower power means better sight

## Vision-enhancing pigment lutein makes its way into eggs

LISA MCLEAN and MURRAY TONG

Canadians at risk of developing vision problems such as cataracts and macular degeneration should be seeing more yellow on their dinner plates, says Prof. Steve Leeson of the University of Guelph's Department of Animal and Poultry Science. He's putting lutein — a yellow pigment that prevents these eye problems and improves general eye health — into eggs.

So far, Leeson has developed eggs that contain 10 times the lutein in normal eggs, all by enhancing chicken feed with a lutein-rich natural product: marigolds.

"Lutein is very good for lowering the risk of these eye problems, but many people don't get enough of it or even know of its benefits," he says. "We hope that putting it into eggs will help them get enough lutein without dramatically changing their diet."

Lutein is found in kale, spinach and broccoli and, at lower levels, in eggs (it's one of the pigments that give the egg yolk its yellow colour). When consumed in sufficient amounts, the nutrient has been shown to help prevent cataracts and macular degeneration, a condition that causes permanent physical damage to the central vision portion of the eye and affects 30 per cent of people over 60.

Leeson and his research group have found that adding processed marigold petals to feed for layer hens results in lutein-rich eggs. These eggs could be part of a healthy diet for individuals who are at risk for cataracts and macular degeneration, he says.

Currently, the recommended daily intake of lutein to prevent these conditions is eight milligrams, but most people average less than half a milligram per day. Normal eggs contain about 0.2 mg of lutein, but Leeson's lutein-supplemented eggs contain 10 times that amount — two milligrams. And with the average Canadian eating 200 eggs a year, including those in processed and prepared foods, they're a good vehicle to get more lutein to the public.

"If we can put the nutrients people need in the food they eat, we'll have a healthier population," he says.

Supplements are available on the market, but lutein is a highly unstable compound that can be destroyed by extreme temperatures or exposure to sunlight. When lutein is incorporated into eggs, it's protected and stabilized by the egg proteins. Leeson is currently collaborating with researchers at the University of Manitoba to determine whether lutein is more bioavailable — that is, readily absorbed by

the body — in eggs than in supplements.

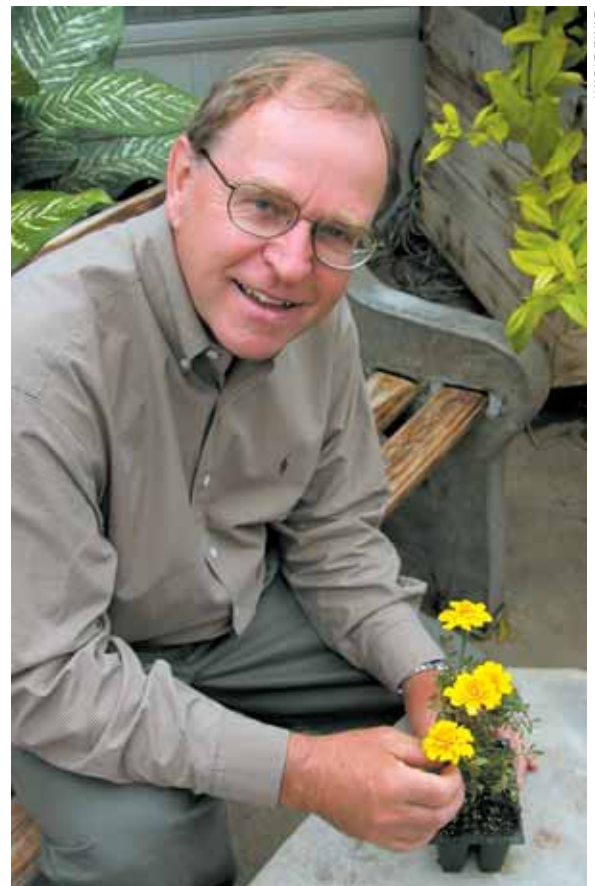
And lutein isn't just good for humans — it's good for the chickens, too. Leeson has found that lutein improves the birds' immune response. He's starting another trial this summer to find out exactly how much the immune response of lutein-fed chickens is heightened, based on how much antibody levels rise and how long the immune response lasts after vaccination.

If it turns out that marigold petals boost poultry immune systems significantly, says Leeson, that means lutein supplements could be an inexpensive and effective way to improve animal health and welfare — not only in layer hens but also in broilers and eventually other animals.

He's one of the researchers who also developed omega-3 eggs, which contain heart-healthy omega-3 fatty acids and are a big seller in North America, accounting for five per cent of Canada's egg market. He eventually hopes to combine his lutein findings with his previous research to produce a "super-egg" that's enriched with lutein, omega-3 fatty acids and other functional ingredients, helping to further boost egg sales and maintain a healthier population.

This research is sponsored by the Canadian Egg Marketing Agency, Egg Producers of Ontario, Kemlin Industries, the Ontario Ministry of Agriculture and Food, Roche Canada, and Science and Engineering Research Canada. ☺

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Olivia Brown

University of Guelph Prof. Steve Leeson is putting lutein — a yellow pigment found in marigolds that boosts eye health in humans — into chicken feed to produce lutein-rich eggs.



# A bioactive boost for soy

## Fermenting soy milk could offer extra health benefits for consumers

SARAH FISCHER

Combining the benefits of two conventional health foods — soy and fermented milk products — could create a new infection-fighting product readily available on grocery store shelves.

Prof. Julia Green-Johnson of the University of Ontario Institute of Technology is working with Agriculture and Agri-Food Canada researchers to combine the health benefits of fermented milk products such as yogurt — which contains probiotic or “good” bacteria that boost immune response and help the body resist infection — with the anti-inflammatory benefits of soy, by developing fermented soy milk as an alternative foodstuff.

Green-Johnson says soy has properties that reduce inflammation in gastric epithelial cells (the cells of the human stomach lining and intestinal tract) by inhibiting the action of naturally secreted molecules responsible for causing acute inflammation in the intestinal tract, such as interleukin-8.

“Fermented milk products such as yogurt could help the body fight off infection,” she says. “Preparing similar products from soy may further increase soy’s nutritional value and potentially improve its anti-inflammatory properties.”

When humans suffer from infection, the immune system responds by attacking invading organisms and discouraging them from growing and spreading in the stomach. If the response is too vigorous, however, it may cause inflammation and even contribute to damage from the invading bacteria.

So Green-Johnson is determining whether fermenting soy with probiotic bacteria will enhance its anti-inflammatory properties.

To do this, she and her colleagues will use intestinal cell cultures in growth media supplemented with fermented soy extracts and probiotic bacteria strains used in fermented milk products. From there, they will add disease-causing bacteria such as *Salmonella* and see how well the cells fight off infection when compared to cells that haven’t been treated with the extract.

If the enhanced cells produce bacteria that can fight off infection and produce anti-inflammatory benefits, Green-Johnson will try to determine how

these benefits are produced and isolate the components that provide them. She hopes to eventually develop a fermented milk and soy product with even more effective probiotic strains.

“Consumers today are interested in soy’s potential health benefits and how these benefits can be included in their diets,” she says. “Using our knowledge about potential immune-enhancing benefits of fermented milk products to add to the health benefits of soy will give consumers another opportunity to include soy in their diet and improve their health.”

This research is sponsored by Agriculture and Agri-Food Canada, the Ontario Ministry of Agriculture and Food and Lallemand Inc. ☺

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Olivia Brown

Fermented dairy foods such as frozen yogurt are getting a functional boost from soy, thanks to University of Ontario Institute of Technology research.

# What consumers don't know can hurt sales

## Why are some technologies welcomed and others feared?

HEATHER FILBY

Most consumers don't think twice about buying milk that's been pasteurized, but another technology — genetic modification — often raises a red flag. University of Guelph researchers are leading a study to determine why some food technologies are more acceptable than others, and what the agriculture and food industry can do to boost consumer acceptance.

Prof. Spencer Henson, Department of Agricultural Economics and Business, says preliminary results suggest the trade-off between perceived risks and benefits is one of the most important influences on how consumers receive new food technologies.

“Consumers are willing to take a risk if they receive greater benefits such as improved health, better quality or lower price,” says Henson. “If the benefits outweigh the perceived risks, consumers are more likely to buy into the product.”

Consumers are influenced by what he calls “the dread factor.” For example, cancer is such a feared disease that consumers won't accept any food technology that's been associated with it, no matter how tenuous the connection.

Other significant factors, says Henson, include whether consumers believe they can control exposure to the new technology, how well they themselves understand the technology and whether they think the technology is understood by scientists.

His research team is using a unique respondent-designed survey that allows consumers to articulate their food technology concerns in their own words. Participants are presented with existing food technologies such as food additives, genetic modification, irradiation, vacuum packing, pasteurization, microwave ovens and canning, as well as non-food technologies such as X-rays, nuclear power, cell-phones, computers and aircraft. The survey then asks participants to indicate, in their own words, which technologies concern them and why.

Henson says the survey results will help determine what values drive consumer choices, which in turn can help industries and the government promote their products in a way that maximizes consumer acceptance. That could boost companies' sales and

give them a competitive edge in national and international markets while addressing consumer concerns about new food technologies.

In the future, Henson and his research group will conduct in-depth case studies on specific food technologies and see how the food industry manages consumer concerns. By the end of the summer, he also hopes to create a tool to predict how a new food technology will be perceived by consumers.

“Industries have to build up consumer acceptance of a product right from the start, not when it's about to hit the market,” he says.

U of G members of his interdisciplinary research team are Profs. John Cranfield and David Sparling and post-doctoral researchers Mamane Annou and Deepananda Herath,

Department of Agricultural Economics and Business; Prof. Rickey Yada, Department of Food Science; and Prof. Valerie Davidson, School of Engineering. Also on the team are University of Saskatchewan agricultural economics professor Jill Hobbs and Timothy Beattie, a post-doctoral researcher at the University of British Columbia.

This research is sponsored by the Ontario Ministry of Agriculture and Food and the Advanced Food and Materials Network. ☺

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Consumers weigh the perceived risks and rewards of certain food technologies – such as genetic modification, irradiation or additives – before buying food products, according to a University of Guelph survey.



Martin Schwalbe



# A GUIDE TO Who's Who IN AGRI-FOOD AND HEALTH INNOVATION IN ONTARIO

## Research and training

Advanced Foods and Materials Network  
of Centres of Excellence  
[www.afmnet.ca](http://www.afmnet.ca)  
Contact: Tania Framst [tfamst@uoguelph.ca](mailto:tfamst@uoguelph.ca)

Agriculture and Agri-Food Canada  
Eastern Cereal and Oilseed Research Centre  
<http://Res2.agr.ca/ecorc>

Food Research Program  
<http://Res2.agr.gc.ca/guelph>

Greenhouse and Processing Crops Research Centre  
<http://Res.agr.ca/harrow>

Southern Crop Protection and Food Research Centre  
[www.agr.ca/london/pmrc](http://www.agr.ca/london/pmrc)

Canadian Research and Development Centre for Probiotics  
Lawson Health Research Institute  
[www.crdc-probiotics.ca](http://www.crdc-probiotics.ca)  
Contact: Gregor Reid [gregor@uwo.ca](mailto:gregor@uwo.ca)

Cool Climate Oenology and Viticulture Institute (CCOVI),  
Brock University  
[www.brocku.ca/ccovi/index.html](http://www.brocku.ca/ccovi/index.html)  
Contact: [ccovi@brocku.ca](mailto:ccovi@brocku.ca)

Guelph Food Technology Centre  
[www.gftc.ca](http://www.gftc.ca)  
Contact: [gftc@gftc.ca](mailto:gftc@gftc.ca)

Loyalist College  
Biofood and biotechnology technician training  
[www.loyalistic.on.ca/Loyalist/index\\_e.aspx?DetailID=190](http://www.loyalistic.on.ca/Loyalist/index_e.aspx?DetailID=190)

Supercritical CO<sub>2</sub> extraction pilot plant  
Contact: Prof. Kari Kramp [kkrap@loyalistic.on.ca](mailto:kkrap@loyalistic.on.ca)

Ontario Centres of Excellence Inc.  
[www.oce-ontario.org/centres/theprogram/bulletin.html](http://www.oce-ontario.org/centres/theprogram/bulletin.html)

Program in Food Safety, Nutrition and Regulatory Affairs

University of Toronto  
[www.utoronto.ca/nutrisci/foodsafety.html](http://www.utoronto.ca/nutrisci/foodsafety.html)

Contact: [program.foodsafety@utoronto.ca](mailto:program.foodsafety@utoronto.ca)

Public Health Agency of Canada

Laboratory for Foodborne Zoonoses  
[www.phac-aspc.gc.ca/lflz-llczoa/index\\_e.html](http://www.phac-aspc.gc.ca/lflz-llczoa/index_e.html)

University Health Network  
[www.uhn.ca](http://www.uhn.ca)  
Contact: [uhn.info@uhn.on.ca](mailto:uhn.info@uhn.on.ca)

University of Guelph  
Office of Research  
[www.uoguelph.ca/research](http://www.uoguelph.ca/research)  
Contact: Marianne Clark [mclark@uoguelph.ca](mailto:mclark@uoguelph.ca)

Canadian Network of Toxicology Centres  
[www.uoguelph.ca/cntc](http://www.uoguelph.ca/cntc)  
Contact: Donna Warner [dwarner@uoguelph.ca](mailto:dwarner@uoguelph.ca)

Canadian Research Institute for Food Safety  
<http://www.uoguelph.ca/OAC/CRIFS>  
Contact: [crifs@uoguelph.ca](mailto:crifs@uoguelph.ca)

Centre for Food and Soft Materials Science  
<http://fsm.uoguelph.ca/>  
Contact: John Dutcher [dutcher@physics.uoguelph.ca](mailto:dutcher@physics.uoguelph.ca)

Food Safety Network  
[www.foodsafetynetwork.ca/](http://www.foodsafetynetwork.ca/)  
Contact: Doug Powell [dpowell@uoguelph.ca](mailto:dpowell@uoguelph.ca)

Human Nutraceutical Research Unit  
[www.uoguelph.ca/hnru](http://www.uoguelph.ca/hnru)  
Contact: [hnru@uoguelph.ca](mailto:hnru@uoguelph.ca)

Students Promoting Awareness  
of Research Knowledge (SPARK)  
[www.uoguelph.ca/research/communications](http://www.uoguelph.ca/research/communications)  
Contact: Marianne Clark [mclark@uoguelph.ca](mailto:mclark@uoguelph.ca)

## Government

Agriculture and Agri-Food Canada  
Ontario Regional Office  
[www.agr.gc.ca](http://www.agr.gc.ca)  
Contact: Gary Nelson [nelson@agr.gc.ca](mailto:nelson@agr.gc.ca)

Ontario Ministry of Agriculture and Food

Innovation and Risk Management Branch  
<http://www.gov.on.ca/OMAFRA/english/research/branch.htm>

Ontario Ministry of Economic Development and Trade  
[www.ontario-canada.com/ontcan/en/rtts.jsp](http://www.ontario-canada.com/ontcan/en/rtts.jsp)  
Contact: [info@edt.gov.on.ca](mailto:info@edt.gov.on.ca)

Ontario Ministry of Health and Long Term Care  
[www.health.gov.on.ca](http://www.health.gov.on.ca)  
Contact: [info@online@moh.gov.on.ca](mailto:info@online@moh.gov.on.ca)

## Commercialization and intellectual property development

Bioenterprise  
[www.bioenterprise.ca](http://www.bioenterprise.ca)  
Contact: Linda Thompson [Linda.thompson@bioenterprise.ca](mailto:Linda.thompson@bioenterprise.ca)

Food Innovation Network  
Contact: Carolyn Moore [camoore@uoguelph.ca](mailto:camoore@uoguelph.ca)

Guelph Partnership for Innovation  
[www.guelphinnovation.com](http://www.guelphinnovation.com)  
Contact: [info@guelphinnovation.com](mailto:info@guelphinnovation.com)

Medical and Related Sciences Discovery District  
[www.marsdd.com](http://www.marsdd.com)  
Contact: [marsddiscoverydistrict@marsdd.com](mailto:marsddiscoverydistrict@marsdd.com)

MaRS Landing  
[www.marslanding.ca](http://www.marslanding.ca)  
Contact: John Kelly [john.kelly@marslanding.ca](mailto:john.kelly@marslanding.ca)

National Research Council –  
Industrial Research Assistance Program  
<http://irap-pari.nrc-cnrc.gc.ca>  
Contact: Frank Holmes [Frank.holmes@nrc.gc.ca](mailto:Frank.holmes@nrc.gc.ca)

Ontario Agri-Food Technologies Inc.  
[www.oaft.org](http://www.oaft.org)  
Contact: [info@oaft.org](mailto:info@oaft.org)

Ottawa Life Sciences Council  
[www.olsc.ca](http://www.olsc.ca)  
Contact: [info@olsc.ca](mailto:info@olsc.ca)

Toronto Biotechnology Initiative  
[www.torontobiotech.org](http://www.torontobiotech.org)  
Contact: [info@torontobiotech.org](mailto:info@torontobiotech.org)

Soy 20/20  
[www.soy2020.ca](http://www.soy2020.ca)  
Contact: Greg Penner [gpenner@soy2020.ca](mailto:gpenner@soy2020.ca)

The Stiller Centre for Life Sciences  
[www.lbcc.on.ca](http://www.lbcc.on.ca)  
Contact: [aggie@stillercentre.com](mailto:aggie@stillercentre.com)

University of Toronto Innovations Foundation  
[www.innovationsfoundation.com](http://www.innovationsfoundation.com)  
Contact: [info@innovationsfoundation.com](mailto:info@innovationsfoundation.com)

## Analysis

Canadian Food Inspection Agency – Laboratories  
[www.inspection.gc.ca/english/sci/lab/labe.shtml](http://www.inspection.gc.ca/english/sci/lab/labe.shtml)

Health Canada  
[www.hc-sc.gc.ca](http://www.hc-sc.gc.ca)

Maxxam Analytics Inc.  
[www.maxxam.ca](http://www.maxxam.ca)  
Contact: [info@maxxamanalytics.com](mailto:info@maxxamanalytics.com)

University of Guelph Lab Services Division  
[www.labservices.uoguelph.ca](http://www.labservices.uoguelph.ca)  
Contact: [info@lsd.uoguelph.ca](mailto:info@lsd.uoguelph.ca)

## Investment

Agricultural Adaptation Council  
[www.adaptcouncil.org](http://www.adaptcouncil.org)  
Contact: [info@adaptcouncil.org](mailto:info@adaptcouncil.org)

CanAdvance Program  
[www.adaptcouncil.org/current\\_programs/canadvance.asp](http://www.adaptcouncil.org/current_programs/canadvance.asp)

Canada-Ontario Research and Development Program  
[http://www.adaptcouncil.org/current\\_programs/cord4.asp](http://www.adaptcouncil.org/current_programs/cord4.asp)

Farm Credit Canada  
<http://www.fcc-fac.ca/>  
Contact: James Taylor [jim.taylor@fccventures.ca](mailto:jim.taylor@fccventures.ca)

Foragen Technologies Management Inc.  
[www.foragen.com](http://www.foragen.com)  
Contact: Murray McLaughlin [Murray.mclaughlin@foragen.com](mailto:Murray.mclaughlin@foragen.com)

Investico Capital  
[www.investico.com](http://www.investico.com)  
Contact: Michael Curry [mcurry@investico.com](mailto:mcurry@investico.com)

Royal Bank of Canada Agriculture and Agribusiness  
[www.rbcroyalbank.com/agriculture/](http://www.rbcroyalbank.com/agriculture/)  
Contact: Gwen Paddock [Gwen.paddock@rbc.com](mailto:Gwen.paddock@rbc.com)

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Guelph is leading the life science industry into the future. Known for its agricultural strengths, Guelph is taking its traditional industries and helping them transform to meet the needs of the marketplace.

Home to a cluster of over 70 companies and 24 research institutes working in such diverse life science fields as chronic disease prevention, food and drug development, diagnostics, bio-based materials and animal genetics, Guelph is expanding its reputation as one of Canada's leading research and development centres.

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[guelph.ca/biz](http://guelph.ca/biz)