Table of contents

Shaping Canada’s food processing future ........................................................................................................... 3

Theme: Enhancing quality
• Bonduelle North America: Maintaining flavour while ensuring the safety of processed vegetables ............... 4

Theme: Adding value to agricultural products
• PEI Berries Ltd.: All the benefits of a fresh, whole blueberry – in a bottle........................................................ 6

Theme: Food safety
• Maple Leaf Foods: Innovative bacon production processes meet food safety standards................................. 8
• Bonduelle North America: Improving the taste and texture of frozen fruits and vegetables .............................. 10

Theme: Advancing health and wellness
• InfraReady Products: Baked goods high in antioxidants can boost human health.............................................. 12
• Burnbrae Farms: Turning eggshells into a functional food ingredient ................................................................. 14
• Bonduelle North America: Validating the safety of new canning technologies for the vegetable industry .......... 16
• IGY Inc.: New technology adds value to under-used agricultural products .................................................... 18
• Global Foods Inc.: Getting the health benefits of oats and barley more easily ................................................ 20

About Canadian Food Innovators and Canadian Council of Food Processors ................................................. 22

A key benefit of the CFI cluster is collaboration and knowledge sharing. Principal investigators of CFI-funded projects, Agriculture and Agri-Food Canada (AAFC) staff and CFI representatives were hosted by AAFC at its Food Research Development Centre in St-Hyacinthe for a tour of the facility, sharing of project developments to date, and network building.
Shaping Canada’s food processing future

Food processing is the critical link in the “fork to farm” value chain that transforms agricultural products for consumers.

In Canada, the sector produces goods valued at over $105 billion each year and is the largest manufacturing industry in the country, accounting for 16 per cent of all manufacturing shipments, two per cent of national GDP, and 250,000 jobs nation-wide, many in rural and agricultural areas.

Canada’s food industry supplies about 77 per cent of all processed food and beverage products available domestically and is the largest buyer of Canadian agricultural products.

Canada exports food products to more than 180 countries, and although two-thirds of Canadian exports are destined for the U.S. market, opportunities in other markets, like China, are growing.

In spite of this success, there is a need to do more to stimulate innovation and growth in the sector.

The Canadian Council of Food Processors (CCFP) has created Canadian Food Innovators (CFI), an incorporated, federal not-for-profit organization with a mandate to develop and manage a five-year research cluster for the food and beverage processing sector under the AgriInnovation Program: Industry-led Research and Development - Agri-science cluster funded through Growing Forward 2, a federal-provincial-territorial initiative.

The cluster is key to addressing high priority issues in the sector in partnership with industry and academia, and better connecting the needs of food and beverage processors with available capacity and resources at Agriculture and Agri-Food Canada (AAFC) research centres, and Canadian universities and food technology centres.

The benefit is far-reaching and broad-based for Canada as the cluster’s projects bridge the production and processing segments of the national agri-food value chain, and many are targeting the health and wellness potential of Canadian food products through both formulation and innovative processing technologies.

It is important to note that the cluster has benefited immensely from the support of AAFC and its staff. Without the resources of the cluster program, it’s unlikely that any of these projects would have been undertaken.

This publication highlights the cutting edge work supported through the CFI cluster. We’re proud to introduce you to some of Canada’s leading food innovators.

David Shambrock, Chair
Canadian Food Innovators & Canadian Council of Food Processors
Maintaining flavour while ensuring the safety of processed vegetables

It’s generally accepted that heating vegetables before freezing or canning them – using a process called blanching – will affect their taste and texture. And yet heat treatment is considered necessary to ensure food products are safe for human consumption.

But what if certain vegetables that are really fragile to blanching actually don’t require the same heat treatment intensity in order to ensure food safety?

Do the enzymes in the produce responsible for the taste deterioration after blanching cause that same change in flavour when less heat or even no heat treatment at all is used – or if the vegetables are partially dehydrated instead?

That’s what technical and product development staff at Bonduelle North America and researchers Tony Savard and Lamia L’Hocine from Agriculture and Agri-Food Canada’s Food Research Development Centre (FRDC) in St-Hyacinthe, are trying to determine.

“We want to find a way to process vegetables as close to fresh as possible for food service and retail,” explains Michel Casgrain, Corporate Director of Research and Development at Bonduelle. “If we are successful, it opens the door to expanded production and processing of vegetables, especially those that are very fragile to heat treatment.”

The research involves monitoring the development of undesirable flavours based on the enzyme levels in various vegetables and determining whether conventional blanching is even needed in vegetables like onions or peppers, which are particularly affected by that process.

To date, no single enzyme has been found across all vegetables as the cause for the change in taste. A literature review has identified a few that seem to be leading candidates, and researchers at FRDC are working to validate these findings.

Over 500 pounds each of peppers, zucchini, mushrooms and onions have been assessed and tested so far, with some undergoing reduced blanching treatments and others being partially dehydrated instead. Initial sensory analysis has shown positive results in peppers and zucchini four months after processing, but the results have not been as successful for onions or mushrooms.

Why is this innovation important?

- **Food safety:** This will ensure vegetables processed using these new technologies will meet existing rigorous standards for food quality and safety.
- **Health:** An overall improvement in the quality of frozen vegetables could lead to increased access and consumption, which will have positive health impacts on Canadians.
- **Markets:** This technology could open new markets for frozen vegetable products and reduce food waste.
For example, partially dehydrated zucchini as well as those treated with a reduced blanching regimen showed increased crunch and sweetness when compared to those that went through a traditional blanching treatment. Partially dried red peppers were also found to be crunchier and sweeter than conventionally treated ones.

Although this is a positive initial outcome, researchers say more time is needed to determine how the partial dehydration will impact shelf life over the longer term, and whether any links exist between enzyme levels, flavour, and taste. Moreover, the safety of those reduced thermal treatments hasn’t yet been tested, and challenge tests are planned to evaluate food safety.

During the second year of the project, FRDC researchers will also be applying protocols they’ve developed to measure the impact of reduced blanching on the quality and safety of the processed vegetables and analysing the results.

It is estimated that if the technology is successful, a move away from conventional blanching methods will improve food quality without compromising safety, lower processing times, reduce processing costs, and open new product and market opportunities for vegetable and fruit processors.

About Bonduelle Group
The French family-run Bonduelle Group is one of the largest fruit and vegetable processors in the world with markets in over 100 countries and more than 50 processing facilities worldwide. Bonduelle’s Canadian presence includes offices in Quebec and Ontario, and four processing plants in Quebec, three in Ontario, and one in Alberta, where they make product for national and private label brands such as President’s Choice, Selection, Irresistible, Green Giant, and Arctic Garden.

foodservice.bonduelleamericas.com/en/

About the project team
Dr. Tony Savard is a research scientist in food microbiology with Agriculture and Agri-Food Canada’s Food Research Development Centre in St-Hyacinthe. He holds a BSc and a PhD in Microbiology and an MSc in Neurophysiology, all from Université de Sherbrooke.

Dr. Lamia L’Hocine has been a research scientist at Agriculture and Agri-Food Canada’s Food Research Development Centre in St-Hyacinthe since 2008. She completed a Bachelor’s Degree in food science at the Algerian National Agronomy Institute, and an MSc and PhD in food science and technology at Jiangnan University in China.

What does this innovation mean to Canada’s food processing industry?
Project outcomes, if successful, will open the doors to expanded production and processing of vegetables, especially those that are very sensitive to current blanching processes, and provide superior quality and nutrition.
All the benefits of a fresh, whole blueberry – in a bottle

Blueberries, especially wild varieties, are well-known for their health-boosting antioxidants. Imagine a product that can give you the full health benefits of eating fresh blueberries – but in liquid form.

That’s PURE Blueberry, a unique new blueberry purée now on the market that was the winner of an innovation prize at the SIAL food exposition in Montreal last year.

Here’s what sets it apart from other liquid blueberry products, like juice.

PURE Blueberry is made using a new production process that liquefies the entire berry (peel, seed and pulp) and better preserves the fruit’s nutritional value. HydroThermoDynamics (HTD) allows the berries to be processed at lower temperatures in a closed system that protects nutrients from oxidation. The result is two times more antioxidants than the best wild blueberry juice.

Dr. Alex Martynenko of Dalhousie University’s Faculty of Agriculture, who originally worked on cavitation technology in his native Ukraine, has teamed up with PEI Berries Ltd. and Dr. Lihua Fan of Agriculture and Agri-Food Canada’s Atlantic Food and Horticulture Research Centre, Kentville NS to help them develop new products using blueberries, cranberries, and strawberries, but without additives or preservatives.

“We needed to develop quality and food safety standards, so we successfully tested the technology on an industrial scale in 2013 with 28 small scale runs of wild blueberries,” explains Dr. Martynenko.

And although the process was successful, a new challenge arose: they weren’t able to get a consistent product that also had a consistent shelf-life. In order to maintain the product’s health benefits, a low temperature process has to be used, but this change impacts its microbial stability and affects shelf-life.

Why is this innovation important?

- **Health:** A liquid form of whole pure blueberries that includes the peel, seed and pulp will make it easier for people to benefit from their healthy properties.
- **Food safety:** Processes have been developed to ensure the technology produces safe food products without diminishing their health benefits.
- **Economics:** This technology will enable the berry sector to bring unique, new products to market, helping strengthen their long-term viability in Canadian agriculture and food processing.
Through funding support received from the cluster, Dr. Martynenko began working with researchers at Agriculture and Agri-Food Canada to look at heat-resistant moulds and how to reduce associated food safety risk in order to get a shelf-life of at least one year.

“This technology is quite versatile for a variety of berries, allowing us to develop natural berry food products with minimal modification of our processing lines,” he points out.

Results have shown that combining HTD with temperature completely sterilized the product at 95°C, which is superior compared to conventional heat treatment. As well, combining high-intensity HTD with temperature treatments of 88 to 94°C also achieved safe food standards.

The major benefits of the HTD process include increasing the vitamin availability in fruits or vegetables, retaining their natural proteins and polyunsaturated fatty acids, converting fibre into monosaccharides which increases sweetness, and inactivating microorganisms. It can also convert almost any fruit or vegetable to a powdered form.

Dr. Martynenko adds that the developments of this technology and related processes will provide new opportunities for the berry sector, letting them access the global market with innovative products that were not previously available.

Next steps in the research include clinical trials to study the short-term human health effects of PURE Blueberry, and evaluate consumer perceptions and sensory characteristics. Dr. Martynenko and PEI Berries are also working on using HTD on cranberries, with plans to move to strawberries and black currants in upcoming years.

Future opportunities include development of new foods with health-promoting properties, improving the palatability of functional foods with a short shelf-life, and the ability to extract bioactives or other functional ingredients.

“We couldn’t do this work without the support from the Canadian Food Innovators cluster – PEI Berries is a small company run by farmers that wouldn’t otherwise have the resources to hire specialists to do this work for them,” states Dr. Martynenko.

**About PEI Berries Ltd.**

PEI Berries is a farmer-owned food processing facility based in Montague, Prince Edward Island. The farmers that ship to PEI Berries all believe in a sustainable approach, including not using any fungicides or insecticides on their blueberries, with the long term goal of having fully certified organic inputs. Its flagship product is a 100 percent PURE Wild Blueberry Puree. [www.peiberries.com](http://www.peiberries.com)

**About the project team**

**Dr. Alex Martynenko** is an Associate Professor in the Department of Engineering at Dalhousie University’s Faculty of Agriculture where his research includes computer-vision, imaging, bioinstrumentation, and agricultural automation. Dr. Martynenko holds a BSc. in engineering from the National Agricultural University of Ukraine, a Master’s in Agricultural Engineering from Moscow Agroengineering University, and a PhD in Biological Engineering from the University of Guelph.

**Dr. Lihua Fan** is a Research Scientist in Agriculture and Agri-Food Canada’s Atlantic Food and Horticulture Research Centre with extensive experience in food science and food microbiology. Her research projects focus on the study and characterization of heat-resistant moulds in wild blueberry products, and she is involved in the determination of time/temperature conditions to inactivate heat-resistant moulds in blueberry juice and shelf-life studies to address food safety issues.

**Dr. Bohdan Luhovyy** is an Assistant Professor of Applied Human Nutrition at Mount Saint Vincent University and has extensive experience in the area of nutritional physiology and functional foods. His work includes nutritional clinical trials using Canadian crops and innovative food products, focusing on the regulation of food intake, satiety, blood glucose control, and prevention of metabolic disorders including obesity and type-2 diabetes.

**What does this innovation mean to Canada’s food processing industry?**

Use of HTD in food processing opens up new opportunities for developing foods with health-promoting properties, as well as the ability to extract bioactives or other functional ingredients.
Bacon can be produced safely under certain processing methods that fall outside of new guidelines released by the Canadian Food Inspection Agency (CFIA).

That’s the finding of newly completed research carried out by Maple Leaf Foods and the University of Alberta that looked at the possible growth of *Staphylococcus aureus* and *Clostridium perfringens* during a six-hour cooling regime for producing bacon.

“We’ve been processing and eating bacon for a long time, but the CFIA had some issues with innovations we were intending in our Winnipeg plant,” explains Dr. Peter Slade, Senior Director of Science with Maple Leaf Foods. “Any processes that fall outside of CFIA requirements have to be validated to prove their safety. We found we didn’t have all of the necessary data, which is what led to this project.”

The innovation in question is a U.S.-style bacon product that needs a lower cook temperature than other bacon products in order to keep the desirable slicing characteristics consumers want.

What does this innovation mean to Canada’s food processing industry?

Study results can be used by the meat industry to gain approval from CFIA to cool bacon slowly (i.e. over a six-hour period) without affecting Canada’s high food safety standards.
Normally, a bacon cook process will heat the product into the high 50 C range. Maple Leaf’s new U.S.-style bacon only reaches temperatures of 48 – 55 C, so the company had to prove that the lower cooking temperatures followed by slower cooling rate could still result in a safe product for consumers.

“We normally use models to satisfy regulators that we are within safety parameters, but in this case, both European and U.S. models for Staph have conditions within them that don’t cover the entire range of the bacon temperature curve during both the heating and cool down processes,” says Dr. Slade.

To meet CFIA guidelines, researchers evaluated several processing scenarios: a cooling regime to bring the bacon temperature from 48.8 C to 26.6 C within one hour followed by cooling to 4 C and the impact of cooling from 48.8 C to 12.7 C in six hours followed by cooling to 4 C. Cooling from 54 C to 26.6 C in three hours, followed by cooling to 4 C was evaluated to assess industrially relevant parameters.

No growth of S. aureus occurred during cooling regardless of how the bacon was cooled, not even during slow cooling over six hours. During cooking and cooling of bacon, no growth of S. aureus occurred even when bacon was slowly cooled from 48.8 to 12.7 C over six hours. This means processors can use these temperature profiles as models to demonstrate production of safe bacon. As well, they can use these research results to seek CFIA for approval of alternative bacon processing methods.

“These results support the safety of bacon produced with a six hour cooling regime,” says Dr. Slade. “Industry now has the data necessary to submit to CFIA to demonstrate that different cooling rates over six hours will not compromise the safety of bacon cooked initially at lower temperatures.”

About Maple Leaf Foods

Maple Leaf Foods is Canada’s leading consumer packaged meats company with leading brands such as Maple Leaf®, Maple Leaf Prime®, Maple Leaf Natural Selections®, Schneiders®, Schneiders Country Naturals® and Mina™. The company employs approximately 12,000 people in its operations across Canada and exports to more than 20 global markets, including the U.S. and Asia. www.mapleleaffoods.com.

About the project team

Dr. Peter Slade is Senior Director, Science at Maple Leaf Foods. Dr. Slade obtained his BSc in Food Science and Microbiology (Hons) at the University of Leeds and holds a PhD in Food Science from the University of Guelph.

Dr. Lynn McMullen is a professor in the Department of Agricultural, Food and Nutritional Science at the University of Alberta. Her areas of interest include control of pathogens in meat using lactic acid bacteria and bacteriocins or other natural antimicrobials and understanding how the microbiota of meat products influences safety and quality. Dr. McMullen obtained her PhD from the University of Alberta in Food Microbiology.

Why is this innovation important?

- **Food safety:** Bacon is being produced safely and consumers can consume bacon products with confidence.
- **Innovation:** Giving industry the flexibility to vary their production processes will lead to new product innovations for Canadian food processors.
- **Economics:** New product innovations could lead to new market opportunities, benefitting not only food processors but also their supply chain partners.
Improving the taste and texture of frozen fruits and vegetables

Theme
Food safety

Project
Anti-microbial protection of frozen vegetables and fruit, which have been partially dried before freezing, by coating and spraying

Industry partner
Bonduelle North America, Saint-Denis-sur-Richelieu QC

Principal investigator
Dr. Monique Lacroix*, INRS-Institut Armand-Frappier, Laval QC

Co-Investigator
Dr. Tony Savard*, Food Microbiologist, Agriculture and Agri-Food Canada Food Research Development Centre, St-Hyacinthe QC

(*funding support provided through the Collaborative Research and Development Agreement – CRDA)

Anticipated completion date
March 31, 2016

Why is this innovation important?

• **Food safety:** This will improve the taste and texture of frozen fruits and vegetables without compromising food safety.

• **Health:** Better tasting frozen produce could lead to increased consumption by consumers – the health benefits of eating fruits and vegetables as part of a balanced diet are well-known.

• **Markets:** New market or product opportunities could result from not having to heat-treat fruits and vegetables before freezing.
They’re working with red peppers, onions and cranberries, which are more fragile to blanching, and have developed an edible antimicrobial coating to be applied using a simple shaker and sprayer system.

Tests will be performed to determine how it can best be uniformly applied, how well it will cling to the produce, and how effective it is at keeping Listeria and other pathogens like Salmonella and E.coli, as well as spoilage microorganisms, at bay.

“The ready-to-eat market is a big one – for example, we could use frozen vegetables in fresh salads if we don’t have to heat them before serving,” adds Falardeau.

To date, Dr. Lacroix’s team has found the coating to be effective in a laboratory setting.

The next step, led by Dr. Savard, will be pilot testing in a commercial setting at the Food Research Development Centre in St-Hyacinthe, followed by performance and sensory evaluation to ensure the coated fruits and vegetables also have a pleasing taste.

What does this project mean to Canada’s food processing industry?
This technology will open up new product development options for Canadian fruit and vegetable processors that weren’t previously possible, resulting in product with enhanced flavour and nutrition.

About Bonduelle Group
The French family-run Bonduelle Group is one of the largest fruit and vegetable processors in the world with markets in over 100 countries and more than 50 processing facilities worldwide. Bonduelle’s Canadian presence includes offices in Quebec and Ontario, and four processing plants in Quebec, three in Ontario, and one in Alberta, where they make product for national and private label brands such as President’s Choice, Selection, Irresistible, Green Giant and Arctic Garden. foodservice.bonduelleamericas.com/en/

About the project team
Dr. Monique Lacroix is a professor at INRS-Institut Armand-Frappier in Laval, Quebec, where she specializes in food technology and food safety, nutraceuticals and probiotics. She holds a BSc and MSc in food science and technology and a PhD in nutrition, all from Université Laval.

Dr. Tony Savard is a research scientist in food microbiology with Agriculture and Agri-Food Canada’s Food Research Development Centre in St-Hyacinthe. He holds a BSc and a PhD in Microbiology and an MSc in Neurophysiology, all from Université de Sherbrooke.
Baked goods high in antioxidants can boost human health

Theme
Advancing health and wellness

Project
In vitro and in vivo studies for characterization and health effects of newly developed purple wheat products

Industry partner
InfraReady Products (1998) Ltd., Saskatoon SK

Principal investigators
Mark Pickard, InfraReady Products; Dr. Amanda Wright, University of Guelph; Dr. Elsayed Abdelaal*, Senior Research Scientist, Agriculture and Agri-Food Canada Guelph Food Research Development Centre, Guelph ON
(*funding support provided through the Collaborative Research and Development Agreement – CRDA)

Anticipated completion date
March 31, 2017

Why is this innovation important?

• **Health:** The antioxidants found in purple wheat can help improve human health, including conditions like inflammation, diabetes, and cancer.

• **Environment:** Purple wheat is a potential sustainable source of natural colorants, antioxidants, and nutraceuticals.

• **Economics:** This novel Canadian product could provide new market opportunities for farmers, processors, and food manufacturers.

It’s well-known that dark blue and purple fruits and vegetables – like blueberries or purple cabbage – are great sources of the anthocyanins or antioxidants we need to stay healthy.

Those antioxidants are scavengers of free radicals – high energy particles in the human body that can damage cells – which mean they can help fight common ailments like inflammation, diabetes, and cancer, as well as help with eye cell repair.

Colourful grains, like the purple wheat grown commercially in Saskatchewan, provide similar benefits.

In fact, purple wheat is also an excellent sustainable source of natural colorants, and is a promising candidate for the development of anthocyanin-rich milling fractions and isolates that could be used as health-boosting food processing ingredients.
So promising, in fact, that InfraReady Products (1998) Ltd. of Saskatoon is working on a project in collaboration with Dr. Elsayed Abdelaal of Agriculture and Agri-Food Canada’s Guelph Food Research Centre to identify the quantity and quality of anthocyanins in new food products made with purple wheat, as well as evaluate their impact on human health.

“This could lead to the development of healthy food ingredients, functional foods, dietary supplements, natural colourants, and natural antioxidants,” says InfraReady CEO Mark Pickard. “Our goal is to promote purple wheat as a value-added crop for Canadian agriculture and create market opportunities for farmers, processors and food manufacturers.”

InfraReady specializes in flaking, milling, granulating, sprouting and custom blending grains, including its AnthoGrain purple wheat variety, which it originally obtained from the Saskatchewan Wheat Pool in the 1990s after the company had discontinued efforts to breed the wheat for ethanol production.

As part of this project, InfraReady developed and prepared six food product prototypes using either purple wheat wholegrain flour or purple wheat wholegrain flour enriched with purple wheat bran to boost anthocyanin content.

This included purple wheat wholegrain bread, purple wheat wholegrain muffin, bran enriched purple wheat whole grain muffin, purple wheat wholegrain pancake, purple wheat flakes, and purple wheat instant flakes.

The products were analyzed at AAFC’s Guelph Food Research Centre for their nutrient and anthocyanin content, and based on the results, two have been selected to move forward to human clinical trials.

“Part of the work we’re doing is looking at the distribution of anthocyanins in the purple wheat,” explains Pickard, adding that most is found in bran, a by-product of the milling process. “It’s still a work in progress but we’re excited about what we think we’ll find and that we can bring it forward in a new way.”

A new line of purple wheat with double the anthocyanins of existing varieties has been developed by the University of Saskatchewan and is now in the final stages of cultivar registration.

About InfraReady Products
InfraReady Products, a specialty processor of cereals, pulses and oilseeds, was started in 1994 by the Saskatchewan Wheat Pool to add value to cereal grains before they left the province. Today, InfraReady offers over 250 custom-designed products made from a wide range of raw materials, including cereal grains, oilseeds and pulses, and markets products to other food manufacturers in Canada, United States, Europe and Southeast Asia. www.infrareadyproducts.com.

About the project team
Mark Pickard is the President of InfraReady Products (1998) Ltd., and has a BSA in Applied Microbiology and Food Science and an MBA from the University of Saskatchewan. Prior to joining InfraReady, Mark was employed by CSP Foods and the Saskatchewan Wheat Pool for 20 years in a variety of research and technical marketing positions.

Dr. Amanda Wright is an associate professor in the Department of Human Health and Nutritional Sciences at the University of Guelph, and Director of the Human Nutraceutical Research Unit. She holds a PhD in Food Chemistry from the University of Guelph.

Dr. Elsayed Abdelaal is a senior research scientist at Agriculture and Agri-Food Canada’s Guelph Food Research Centre where he specializes in grain-based functional foods and natural health products.

What does this innovation mean to Canada’s food processing industry?
This technology will provide antioxidant-rich milling fractions and isolates that could be added to food products to boost human health.
Turning egg shells into a functional food ingredient

When an egg is cracked, the inside is consumed and the shell is considered waste and thrown away.

Canada produces about 615 million dozen eggs per year. About one quarter of those eggs go to the food industry, where they’re broken and used for processing into various products. That results in almost 45,000 tons of egg shells every year that need to be disposed of – and that disposal costs money, an estimated $1 – 2 million annually. And this does not include shells from 70.2 million hatching eggs.

What if, instead, those egg shells could be of value?

That’s what Alphonsus Utioh and his research team at Manitoba’s Food Development Centre in Portage La Prairie, and Burnbrae Farms Ltd., one of Canada’s largest egg producers, have set out to discover.

“Studies have shown that egg shells are a good source of dietary calcium with potential applications for the food, cosmetic and pharmaceutical industries,” says Utioh. “And there are other uses too, such as in animal feed supplements, and in fertilizer as a soil conditioner.”

The shell makes up about 11 per cent of the total weight of an average egg, weighs about six grams and contains approximately 2,200 milligrams of calcium, as well as other minerals such as potassium, magnesium, and iron, and extracts like collagen. The waste when an egg is broken includes both the shell and the membrane.

The key, says Utioh, is to develop a cost effective and simple way to process egg shell powder so it can be used as a functional food ingredient.

Why is this innovation important?

• **Health:** The ground egg shell powder contains 37 to 39 milligrams of calcium per gram, making it a potentially excellent source of calcium in the human diet.

• **Economics:** This innovation lets egg processors not only save money on shell disposal costs, but allows them to open new revenue streams through the added value of the shell powder.

• **Markets:** Development of products incorporating egg shell powder could bring new market opportunities to egg processors, as well as others in the food, cosmetic and pharmaceutical industries.
He’s been working with the Burnbrae egg processing facility in Winnipeg to process the egg shells by washing, sterilizing, drying, grinding and sifting to create an egg shell powder.

Initial analysis of the powder has shown that it’s safe and without bacterial contamination.

“Our preliminary results show potential for this process to produce egg shell powder as a source of dietary calcium at about 38 milligrams per gram of powder, and without any issues related to safety,” he says.

Through the course of the work, Utioh and his team discovered that it could be possible to recover the egg shell membrane through the shell powder process. The membrane contains about 10 per cent collagen, which could be extracted and used for food, cosmetic, and pharmaceutical applications.

Future work includes continuing to optimize the shell recovery process for hardboiled eggs, as well as developing and optimizing a process for raw egg shells. The processed egg shells will be ground to produce egg shell powder with suitable particle size for food applications.

“We expect to develop two food products using egg shell powder and then test them in terms of sensory attributes,” says Utioh. “The question will be whether the market will accept it.”

About Burnbrae Farms Ltd.
Burnbrae Farms is a family owned and operated company that has been producing eggs for over 70 years. Burnbrae is one of Canada’s leading egg producers with farms in Ontario, Quebec, Manitoba and Alberta and British Columbia; and processing plants in Eastern and Western Canada. They sell eggs and egg products including hard-boiled eggs to major grocery store chains, food service operations and large bakery and industrial customers throughout Canada.

www.burnbraefarms.com

About the project team
Alphonsus Utioh is Manager of Research and Development at the Food Development Centre (FDC). He has conducted and managed many industry-driven food processing research and development projects, and has a Master’s degree in Chemical Engineering from the University of Saskatchewan. Alphonsus is a registered Professional Engineer with the Association of Professional Engineers and Geoscientists of Manitoba, and an Adjunct Professor in the Department of Human Nutritional Sciences, University of Manitoba.

Other project team members are Paulyn Appah, PhD, Senior Process Development Consultant with expertise in thermal processing and extrusion; Meeling Nivet, BSc, Group Leader, Product Development with expertise in liquid food processing; Janice Meseyton, BHEc, Senior Product Development Consultant with expertise in bakery and cereal products; Ramachandran Gopal, ME (Ag); and Carol Nabanoba Musoke, BEng, EIT.

What does this innovation mean to Canada’s food processing industry?
This innovation will allow egg processors to turn a costly waste product into a value-added revenue source that is also beneficial for health and nutrition.
Validating the safety of new canning technologies for the vegetable industry

Initial research results are indicating that canned vegetables could potentially be processed safely at lower temperatures – a change that would improve their taste and nutritional qualities.

Currently, food safety regulations governing canning in Canada recognize two thermal processes for canned foods – high acid (pH lower than 4.5) products that need only mild heat (resulting in potentially unacceptable acidic flavour) and low acid products (pH greater than 4.5) that need to be heated to a high temperature in order to ensure safety. Unfortunately, those high temperatures also affect the quality and nutritional value of canned foods.

Dr. Tony Savard is leading a project at the Agriculture and Agri-Food Canada (AAFC) Food Research Development Centre in St-Hyacinthe that is hoping to gain a better understanding of how both Clostridium botulinum and Clostridium sporogenes – a pathogen and its surrogate that can cause food-borne illness – respond to a combination of treatments instead of just a high heat process and is documenting the real thermo-resistance of those strains in a non-regulated zone of pH.

“The current thermo-resistance data and calculations for high thermal processing were done more 50 years ago,” explains Dr. Savard. “We want to use what is called “hurdle technology” – an intermediate pH level combined with reduced thermal processing that will ensure the same food safety while boosting quality and stability.”

What does this innovation mean to Canada’s food processing industry?

A successful project will mean that companies can reduce their levels of thermal processing during canning, leading to tastier, and more nutritious canned vegetables. Overall, this outcome will help the canning sector to increase its worldwide competitiveness.
The general objective, he adds, is to validate how well the pathogens react to heat in acidic conditions both in the lab and at a pilot plant scale. The impact on C. botulinum of salt in canned vegetable liquid as well as a reduction in those sodium levels will also be evaluated.

“Looking at sodium reduction is helping us prepare for potential future developments,” he says, adding that it is important to know whether reduced salt levels that may be introduced down the road could potentially cause resurgence in pathogens like Clostridium.

Experiments have been conducted successfully over the past year involving green beans but raised a few questions that are being answered in this project. Challenge tests will also be performed on carrots to ensure the results are applicable beyond just green beans.

“We’ve found no significant impact on the activation of Clostridium spores either in our buffer or in our green bean slurry, either immediately after processing or after four months, but the way the spores are produced has a significant impact on their resistance to heat,” Dr. Savard says.

Dr. Savard says AAFC has been consulting with both Health Canada and the Canadian Food Inspection Agency on this work since its inception to ensure both agencies are aware of the potential future impact it might have on regulations governing food canning.

About the project team
Dr. Tony Savard is a research scientist in food microbiology with Agriculture and Agri-Food Canada’s Food Research Development Centre in St-Hyacinthe, where he has worked since 1999. He holds a BSc and a PhD in Microbiology and an MSc in Neurophysiology, all from Université de Sherbrooke.

Why is this innovation important?
• **Food safety:** The “hurdle technology” combining acidity and temperature levels meets food safety standards for human consumption.
• **Policy:** Regulations governing thermo-resistance of food-borne pathogens and calculations for high thermal processing were put in place more than 50 years ago, even though technologies have advanced during this time.
• **Markets:** This innovation’s success could help Bonduelle achieve regulatory approval to use reduced thermal treatments to can vegetables – the resulting tastier, more nutritious foods could open new markets for the company.
New technology adds value to under-used agricultural products

A University of Alberta spin-off company is hoping to bring new value to under-used agricultural products by developing specialized protein drinks for Asian markets.

IGY Inc. of Edmonton is working on a technology to solubilize – or liquefy – protein from lower value cuts of meat, a process they’re hoping to then also apply to products prized for their health properties in some nations, like antler velvet or ginseng.

The target audience, says IGY Inc.’s President Gary Villetard, are seniors, hospital patients on restricted diets, and others who have difficulty digesting protein, first in Asian markets like South Korea and Japan and then hopefully in North America.

In collaboration with partners in Japan and South Korea, IGY Inc. and Dr. Hoon Sunwoo from the University of Alberta’s Faculty of Pharmacy and Pharmaceutical Sciences are using a new technology called high hydrostatic pressure combined with enzymatic hydrolysis (HHP-EH), which mimics the digestion of proteins by enzymes in the human gastrointestinal tract.

“This lets us extract protein hydrolysates from various sources of animal proteins that we can then use to develop protein drinks,” explains Villetard. “If you take a chicken breast and run it through this machine, the protein looks like a glass of water.”

What does this innovation mean to Canada’s food processing industry?

HHP-EH technology is quicker and more economical than conventional methods, and produces a product that is stable at room temperature without preservatives.

Theme
Advancing health and wellness

Project
Development of protein hydrolysates and ginseng extracts via innovative high hydrostatic pressure-enzymatic hydrolysis (HHP-EH) technology

Industry partner
IGY Inc., Edmonton AB

Principal investigator
Dr. Hoon Sunwoo, University of Alberta

Anticipated completion date
March 31, 2018
It’s cheaper and faster than conventional methods, with more enzymatic activity and less bacteria growth. Filtration eliminates any indigestible fibres or floating fat – external meat fat can be trimmed before processing, but internal fat can’t be removed until after the meat has been solubilized.

“This process is superior to conventional methods. Liquid meat protein hydrolysates are stable in a glass bottle at room temperature without preservatives for up to six months so far; we will continue testing for up to one year,” says Dr. Sunwoo, adding that the process still needs to be optimized to make it more efficient, something he is now working on with project collaborators in South Korea.

Next steps include developing prototype products, which Villetard hopes to take to Asia for initial feedback at trade shows later this year, then ultimately, establishing commercial scale production.

“Our challenge is keeping the capital costs of upscaling as low as possible, and penetrating the market,” he says. “But our opportunity lies in our low cost of production, a high quality product, and our partners in Japan and Korea who can help us move into those markets.”

About IGY Inc.
IGY Inc. is a University of Alberta spin-off company that creates IGY technology – technologies based on the avian immune system – for the betterment of human and animal health. IGY stands for immunoglobulin Y, which are antibodies found in egg yolk.

About the project team
Dr. Hoon Sunwoo is an Associate Professor in Faculty of Pharmacy and Pharmaceutical Sciences at the University of Alberta. His research centres around translational immunology and biotechnology research for diagnostics, therapeutics, and vaccines based on IGY and engineered antibody technologies.

Gary Villetard is President of IGY Inc., and has over 40 years of marketing experience.

Why is this innovation important?
• **Health:** Animal proteins can be made available to seniors, hospital patients on restricted diets, and others with difficulty digesting protein, in an easy to consume and absorb way.
• **Economics:** This innovation will give new value to under-used agricultural products, which could increase profitability of processors and farmers, as well as create jobs.
• **Markets:** Canadian companies will have access to new segments of the Asian market.
Getting the health benefits of oats and barley more easily

University of Alberta researchers have teamed up with an Alberta food manufacturer to make it easier for Canadians to get the health benefits of barley and oats.

They’ve developed a dry, concentrated form of beta glucan – found in the cell wall of barley and oats – that is easy to use in food processing applications, and could be added to products like baked goods, nutrition bars, pasta, noodles, processed meats, spreads, mayonnaise, and dressings, etc.

Beta glucan has multiple proven health benefits, including positive impacts on cardiovascular health, weight management, gut health, and diabetes management, and has approved health claims for heart health in Canada, the United States, and Europe. It’s also approved for glycemic control in Europe.

Oats and barley are excellent sources of beta glucan, but people must consume significant quantities of oat and barley products daily to get the amount needed – three grams per day – to realize the health benefits.

“Beta glucan has multiple health benefits in a single ingredient and can play a good role in helping people manage their health,” explains Dr. Vasanthan. “Our concentrated form of beta glucan up to 30 per cent (dry weight basis) can easily be incorporated into a variety of foods and doesn’t require people to eat three bowls of oatmeal a day just to realize its health benefits.”

He has developed a patented method for fractionating grain – separating grain components to produce certain concentrates that can be used in food processing applications – and has partnered with Global Foods Canada to develop and commercialize the technology through pre-pilot and pilot studies.
It’s beta glucan’s viscosity that’s the key attribute for health. When consumed, beta glucan and water together form a thick network that works its way through the human digestive tract, trapping bile acid and excreting it instead of sending it back to the liver, which forces the liver to pull more cholesterol from the blood to make up for the loss.

“Barley or oat meal/porridge at home is slimy and thick; that is the presence of the beta glucan. All digestive processes and gastric emptying slow down due to the thickness, so you feel full for a longer period of time,” he explains. “The digestion of starch and absorption of sugars also slows down, which is a diabetic benefit because you can control blood sugar levels.”

Cerabeta™

The product Dr. Vasanthan has developed is a dry concentrate called Cerabeta, which contains up to 30 per cent beta glucan, costs about 3.5 cents per serving, and is an eligible food ingredient for health claims in Canada, the U.S., and Europe.

Pilot and commercial scale testing is ongoing to help establish prices for both primary and co-products, develop product formulations, and determine how to present the products to the marketplace.

To isolate grain components, Dr. Vasanthan has developed a low cost system that uses air-currents in combination with sieves to achieve separation. It’s easily automatable and simple to scale up to pilot scale fibre production.

“We have spent a lot of time optimizing the operating parameters,” he says, adding they’ve also developed nutritional panels for Cerabeta, as well as a spec sheet for potential Cerabeta customers.

Researchers have also teamed up with a grain grower in Saskatchewan to ensure they’ll have a consistent supply of the right barley varieties for their product.

About Global Foods Canada

Global Foods mills organic and regular wheat, rye, barley, oat and flax to produce breakfast cereal blends, waffle and pancake mixes, flours, and smoothie boosters. Their products are sold in five Canadian provinces and one territory.

About the project team

Dr. Thava Vasanthan is a Professor in the Department of Agricultural, Food and Nutritional Science at the University of Alberta, where he focuses on grain processing science and technology. He holds a BSc in Agriculture – Food Science and Technology from University of Peradeniya in Sri Lanka, an MSc in Food Technology from University of Reading in the United Kingdom, and a PhD in Food Science from Memorial University in Newfoundland. Based on the technologies developed in his research lab, he has founded two companies, Cevena Bioproducts Inc. and GranFrac Inc., and taken them to commercial stage.

Why is this innovation important?

• Health: Globally, heart attack, diabetes, and obesity are rising – beta glucan can help alleviate these health issues.
• Economics: It’s a low cost technology that is easily scalable to pilot and commercial settings and will make it easier for consumers to get the necessary amount of beta glucan in their diets.
• Markets: Canada’s barley production is increasing – the country currently ranks seventh in global production – and the industry is looking for ways to add value to the crop.
The Canadian Council of Food Processors (CCFP) was incorporated in 2010. Its membership includes the seven provincial and regional food processing associations in the country: Alberta Food Processors Association, Food and Beverage Ontario, Atlantic Food & Beverage Processors Association, British Columbia Food Processors Association, Manitoba Food Processors Association, Quebec Food Processors and Consumer Product Council, and Saskatchewan Food and Ingredient Processors Association. Together, CCFP provincial member associations represent 1,800 companies nationwide.

The national organization represents all sizes of food and beverage processors and natural health products manufacturers operating in Canada.

CCFP’s mission is to raise the profile of the food processing/manufacturing industry in Canada and to speak with a common voice on behalf of its members on a broad spectrum of issues that affect this vital manufacturing industry on a national basis.

In order to participate in the AgrInnovation Program’s Research & Development Stream under Growing Forward 2, CCFP has formed Canadian Food Innovators, a federal not-for-profit corporation.

CFI’s food processing science cluster is national in scope and is an industry-led program that brings together a critical mass of scientific research expertise in industry, academia, and government to accelerate innovation through commercialization and adoption of innovative agri-based products, technologies, processes and services.

The Canadian Food Innovators is funded by Growing Forward 2, a federal-provincial-territorial initiative.