

CANADIAN  
FOOD INNOVATION  
NETWORK



# SPOTLIGHT ON FOOD SAFETY AND CLEAN LABEL RESEARCH (2020)

Accelerating innovation across Canada's food value chain





# ACCELERATING INNOVATION IN CANADA'S NATIONAL FOOD VALUE CHAIN

We're in a time of unprecedented change, and with change comes both challenge and opportunity. Certainly, when it comes to our food and beverages, that change will impact every aspect of its journey from the farm to the dinner table.

Technology and innovation can help us ensure we can continue to feed people and to do so in ever more sustainable ways. Canada has a great reputation as a producer of high-quality food and food ingredients, as well as the potential to capture additional value by boosting its food and beverage manufacturing sector.

Bringing together the people that drive innovation and can deliver results is one of the key mandates of the Canadian Food Innovation Network (CFIN) Emerging Science Research Cluster. The cluster was initiated in 2013 to encourage research collaboration among government, academia and private industry and to help food and beverage processors access innovation funding support.

CFIN Emerging Science Research Cluster is proud to deliver a second series of projects between 2018 - 2023. Ten research projects across Canada are working

on solutions to boost food safety and quality, reduce food waste, develop natural "clean label" products and processes and create value-added products that will address consumer needs.

The benefit is far-reaching and broad-based to address current areas of consumer focus, with examples like clean labels, food safety, plant-based foods, food security, functional ingredients and minimally-processed food and beverage products.

CFIN truly appreciates the federal government's support of this work through Agriculture and Agri-Food Canada's AgriScience program – cluster component under the Canadian Agricultural Partnership, as well as the financial and in-kind contributions by our many industry partners. Their support helps drive innovation in Canada's food sector.

This publication highlights the leading-edge work of five of the cluster's food safety-related projects, and CFIN is proud to shine a spotlight on their activities.

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# USING PULSED LIGHT TO BOOST SAFETY OF FROZEN VEGETABLES

**Project:** Using pulsed light as an antimicrobial treatment of frozen vegetables

**Industry partner:** Bonduelle Americas, St-Denis-Sur-Richelieu QC

**Principal investigators:**

Louis Falardeau, Bonduelle Canada      Louis Sasseville, Cintech Agroalimentaire

A large processor of frozen and canned vegetables in Canada is looking to add a new tool to its roster of processes to ensure safety of its food products.

Bonduelle North America, one of the world’s leading processors of fruits and vegetables, is exploring how to best apply pulsed light technology during a final stage of processing as an additional step to ensure its frozen vegetables are listeria-free. Listeria is a leading cause of foodborne illness and a priority pathogen in the processed frozen vegetable sector.

“Food safety is always important and with pathogens always present and around the corner, we need to continually be developing new tools,” explains R&D Director Louis Falardeau. “Our goal is an additional hurdle for any potential pathogens before going to market. Even though the potential for contamination is already very limited at this point, this is an extra tool in addition to those we are already using.”

Pulsed light is not a new technology, but it has not previously been used for this purpose. This led Bonduelle to team up with food technology center Cintech Agroalimentaire. The goal is to determine how well the process would work on listeria and how to best optimize and scale the technology for a food processing environment.

Researchers are working to find different ways of applying the pulsed light so that it reaches all areas of the vegetables – it’s a non-penetrating light, which means it only kills pathogens on exposed surfaces – in only a short amount of time as they pass through the processing line.

The project is experimenting with different exposure times and energy levels using various application processes to find the optimal set-up for peas, corn, green beans and sliced carrots.

By the end of the project, Bonduelle expects to have confirmation that the technology is working and be ready to do a larger scale pilot. This includes knowing key information like what size of machine would fit into existing processing lines, how the light should be set up, and how treatment must be applied to be most effective.

“The listeria risk is already very low at the end of processing, but only one positive test means product is rejected – so we want to avoid any potential for cross-contamination,” says Falardeau. “This technology will reduce the need for a complex sample testing protocol that could be required for some markets – it’s expensive and time-consuming and ultimately, is still just based on samples.”

The technology is also applicable to other pathogens beyond listeria.

## Why is this innovation important?

**FOOD SAFETY:**  
Pulsed light would be an extra end-step in processing frozen vegetables that eliminates potential residual traces of listeria if it is present on the food.

**HEALTH:**  
Preventing Listeria-associated illness reduces health care costs and economic losses.

**MARKET ACCESS:**  
This use of this technology will ease access to more demanding markets and could reduce the need for costly, time-consuming testing that some customers may require as assurance that frozen vegetables are listeria-free.

**FOOD WASTE:**  
By using new technology to improve food safety, there is also potential to reduce rejected product which ultimately ends up in landfills.



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

This technology will help ensure frozen food products are listeria-free, ensuring food is safe and providing access to global food markets.



### About Bonduelle

The French family-run Bonduelle Group is one of the largest global fruit and vegetable processors 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 products for national and private label brands. [bonduelleamericas.com/ca](http://bonduelleamericas.com/ca)

### About the Project Team

Dr. Louis Sasseville is R&D Project Manager with Cintech Agroalimentaire in St-Hyacinthe, Quebec. He is a graduate of the Université de Montréal, with a PhD in biophysics and molecular physiology, an MSc in physics and biophysics and a BSc in physics.

Louis Falardeau is the R&D Director at Bonduelle Americas, where he is responsible for the frozen and canned vegetables innovation and product development activities in North America. He is a graduate of Université Laval in food science and technology.



# A NATURAL PRESERVATIVE FOR CLEAN LABEL FOOD AND BEVERAGES

**Project:** Development of mushroom chitosan as a natural preservative ingredient for use in Canadian clean label processed food and beverages

**Industry partner:** Chinova Bioworks, Fredericton NB

**Principal investigator:**

David Brown, Chief Operating Officer,  
Chinova Bioworks, Fredericton NB

Food and beverage processors are looking for ingredients to meet the growing demand for clean label foods and products with healthier, more natural ingredients but without compromising product safety or quality.

Chinova Bioworks has invented a natural shelf-life extender called Chiber™ for processed food and beverage products using chitosan, a dietary fibre extracted from white button mushrooms.

“People want healthy, but also convenient food. One of the ingredients consumers have the biggest issue with are chemical preservatives, but in order for processed foods to be convenient to us, they need to have a suitable shelf life and not be full of spoilage bacteria, yeast or mold,” says Chinova Bioworks co-founder David Brown. “Our ingredient Chiber is a healthy, natural fiber that can protect processed foods from spoilage due to microorganisms like mold.”

With support from CFIN, Chinova Bioworks completed a major study into the overall mechanisms of action of the fibre and the highly customized ingredient that could achieve similar results to the traditional chemical preservatives that food companies are trying to replace. Real food models were used to gain an understanding of how Chiber ingredient could work in real processed foods on the market in Canada today.

The company was able to determine the optimal amounts of white button mushroom extract needed to achieve a shelf life comparable to that of synthetic preservatives. They also established how to apply the ingredient in a cost-effective way so that it is an affordable solution for food and beverage processors.

“This project allowed for the development of a final market-ready product that can be used to provide a healthy and natural replacement to synthetic preservatives being used in Canada,” says Brown. “It has given us the data and evidence we need to work with potential clients, and at the same time, make the required regulatory filings in Canada and the United States.”

Chinova’s innovation also creates new value for mushroom growers. Traditionally, the mushroom cap is sold whereas the stem is sent to compost or landfill. That’s the material Chinova uses as feedstock for Chiber™, keeping it out of landfill and adding a new income source for farmers.

The company’s initial client targets are Canadian juice, dairy and plant-based dairy alternative producers. They are also working on versions of their ingredient for the baked goods and sauce segments of the food industry.

## Why is this innovation important?

**FOOD SAFETY:**

Food and beverage processors can lengthen product shelf-life without compromising food quality or safety.

**HEALTH:**

Consumers are seeking healthy, natural alternatives to chemical ingredients, including synthetic preservatives.

**MARKET ACCESS:**

Clean labels can open new market opportunities for food and beverage processors, including emerging markets in craft beverages. They are also important to plant-based and plant-centric product formulations.

**FOOD WASTE:**

Using a waste stream product as the feedstock for this natural ingredient creates immediate reduction in volumes going to landfill, as well as converting waste management expenses to new revenue streams for farmers.



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

A natural antimicrobial allows food processors to achieve clean label requirements, extend the shelf life of their products and increase their ability to sell into global markets. The use of the natural antimicrobial also promotes a circular economy as it is a sustainable process that reduces food waste and extracts more value from raw ingredients.



**About Chinova Bioworks**

Chinova Bioworks is a Canadian company that addresses the growing consumer demand for healthy, natural, clean-label ingredients by providing food and beverage producers with a solution that ensures food safety, shelf life, and product quality. The company has developed an innovative antimicrobial ingredient, Chiber™, that is based on a fiber called chitosan that is extracted from white button mushrooms. [www.chinovabioworks.com](http://www.chinovabioworks.com)

**About the Project Team**

**David Brown**, is co-founder and Chief Operating Officer of Chinova Bioworks. He’s a recipient of the 2017 Governor General’s Innovation Award and a graduate of the University of Alberta.



# IN SEARCH OF A NATURAL SOLUTION AGAINST SPOILAGE BACTERIA AND PATHOGENS IN POULTRY & FROZEN VEGETABLE PRODUCTS

**Project:** The evaluation and implementation of bio-protection and competitive biofilms in the food industry

**Industry partners:** Bonduelle Americas, St-Denis-Sur-Richelieu QC; Exceldor Cooperative, Lévis QC

**Principal investigator:**

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

Two food processing companies, one in meat and one in vegetables, are both looking for chemical-free or “clean” solutions to improve shelf life and the safety of their food products.

Exceldor, a poultry cooperative and processor, is seeking to increase the shelf life of its poultry products, which would reduce food waste and enable the company to supply markets further afield. Foodborne pathogens can lead to illness if there are malpractices in handling, cooking or post-cooking storage of poultry products.

Similarly, Bonduelle, one of North America’s largest fruit and vegetable processors, is looking for antibacterial strategies to protect their processed vegetable products against contamination by pathogens like listeria.

The companies are collaborating on a research project with scientists at Agriculture and Agri-Food Canada’s Food Research and Development Centre in St-Hyacinthe, Quebec to look at biofilms – thin, films of bacteria that adhere to a surface and can be difficult to remove even with chemical intervention.

Specifically, they are hoping they can identify and develop a biofilm that could prevent or destroy listeria or spoilage organisms by providing a hostile environment for them. “We have the same approach but different outcomes – it is challenging to avoid any presence of biofilm as it is always present in some extent in a production environment,” explains Bonduelle Americas R&D Director Louis Falardeau. “What if, instead of trying to remove or destroy this biofilm, we could form a “good one” that would prevent the “bad ones” from forming?”

AAFC research scientist Tony Savard and his team began with sampling processing lines in both companies to establish a baseline of the different strains of microorganisms that can be found in those environments. The next step involves testing different microflora for their ability to prevent growth of listeria and spoilage bacteria.

“Our goal at the end of the project is to have a kind of “recipe” for a biofilm that is effective against listeria and

spoilage bacteria that we can take from the lab to test in real-life, processing plant environments,” adds Falardeau. “We are looking at two ways to address microbiological problems – prevent and destroy. If this technology works, it will be a great innovation.”



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

This technology will help food and beverage processors improve the safety and shelf life of their products using a natural solution to prevent listeria and spoilage bacteria that will also satisfy consumer demand for clean label food products. It also has applicability to other pathogens that will be useful across the food and beverage processing sector.

## Why is this innovation important?

**FOOD SAFETY:**

Listeria is a leading cause of food-borne illness in humans and this technology would help minimize occurrences by improving the safety of processed poultry and vegetable products.

**SUSTAINABILITY:**

Reducing the presence of spoilage bacteria will reduce food waste by improving shelf-life of poultry products and ensuring frozen vegetable products are listeria-free.

**CONSUMER DEMAND:**

Food and beverage processors are looking for clean, natural and chemical-free solutions to boost food safety so they can meet growing consumer demand for clean labels and natural food products.

### About Exceldor Cooperative

Exceldor is a poultry sector cooperative based in Lévis, Quebec. It has plants at Saint-Anselme, Saint-Damase, Saint-Bruno-de-Montarville, and Saint-Agapit in Quebec, in Hanover, Ontario and in Winnipeg, Manitoba, as well as a distribution centre in Beloeil, Quebec. The cooperative markets its products under several brands, including Exceldor, Butterball, Granny’s, and Lacroix. Every year, Exceldor processes in excess of 185 million kilograms of chicken and turkey for the retail, food service, and secondary processing markets at its plants.

[www.exceldor.ca](http://www.exceldor.ca)

### About Bonduelle

The French family-run Bonduelle Group is one of the largest global fruit and vegetable processors 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.

[bonduelleamericas.com/ca](http://bonduelleamericas.com/ca)

### 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.



# AN ECO-FRIENDLY SOLUTION TO PREVENT LISTERIA RISKS IN FOOD PROCESSING ENVIRONMENTS

**Project:** Chemical-free food safety approach to mitigate Listeria in food processing environment

**Industry partner:** Gay Lea Foods Co-operative Ltd, Mississauga ON

**Principal investigator:**  
  
Dr. Hany Anany, Research Scientist, Agriculture and Agri-Food Canada Guelph Research and Development Centre, Guelph ON

A Canadian dairy co-operative has teamed up with Agriculture and Agri-Food Canada to develop a chemical-free way to prevent the risk of listeria in food processing environments.

Listeria monocytogenes is one of the most common food safety risks for humans, and many outbreaks of Listeria-associated foodborne illnesses have been traced back to fresh and ready-to-eat foods like dairy, meat, eggs, vegetables and seafood. And although the incidence rate in Canada is relatively low, improving food safety is an ongoing goal of the country's food and beverage processing sector.

Effective sanitation is key to controlling Listeria in processing environments, but this currently involves the use of strong chemicals that can have a negative impact on the environment as well as lead to the development of antimicrobial resistance.

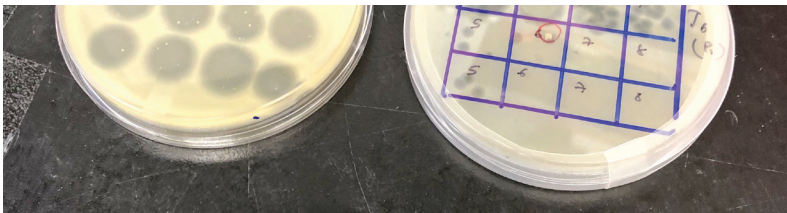
Research scientist Dr. Hany Anany of Agriculture and Agri-Food Canada's Guelph Research and Development Centre is working with Gay Lea Foods to identify and test the effectiveness of natural antimicrobial agents – lytic bacteriophages or bacterial viruses that will specifically target only Listeria bacteria without harming other beneficial species.

"We take sanitation very seriously; we are also attentive to consumer demand for food safety as well as their growing preference for natural products. We know there is data available on using biological agents to reduce pathogenic bacteria in various stages of food production," explains Anilda Guri, Senior Research Scientist at Gay Lea Foods. "So, we took this opportunity to be the first ones in dairy to support this type of research. This is not a mitigation situation, but a way to be proactive for the future."

Anany's research involves identifying different naturally-occurring Listeria phages and evaluating how well different combinations of those phages reduce the growth of Listeria in a dairy processing environment.

The goal is to have a new bio-sanitation agent that can be used to sanitize equipment, food contact surfaces and drains in food processing plants. This will be an environmentally conscious solution that will be an effective alternative to antimicrobial agents.

"Finding green alternatives that will help promote natural compounds to eradicate or control Listeria is very forward-looking on the part of Gay Lea Foods," says Anany. "More eco-friendly alternatives will result in better productivity and better quality in the Canadian food processing sector – and this approach can be expanded to other bacteria in the food industry beyond the dairy sector."



## Why is this innovation important?

**FOOD SAFETY:**  
This will provide a natural way to sanitize food processing environments to ensure the ongoing high standards of food safety that consumers expect.

**HEALTH:**  
Reducing incidences of Listeria-associated foodborne illness will improve human health and reduce the impact of illness on the economy.

**ENVIRONMENT:**  
Bio-based or natural sanitation agents are less harmful to the environment than chemical products currently being used.



## What does this project mean to Canada's food processing industry?

It is anticipated this innovation will enable food and beverage processors to satisfy consumer demand for more natural antimicrobial agents and can be expanded beyond Listeria to address bacteria-driven food safety concerns across the broader food processing sector.

### About Gay Lea Foods Co-operative Ltd.

Gay Lea Foods is a leading Canadian co-operative. Dedicated to innovation, the development of high-quality products and growing the market for Canadian milk, the co-op is 100% Canadian-owned with members on more than 1,400 Ontario and Manitoba dairy farms. The company's award-winning products include: butter, sour cream, whip cream, cheese and cottage cheese.  
[gaylea.com](http://gaylea.com)

### About the project team

Dr. Hany Anany is a research scientist in bacteriophage biology and application with Agriculture and Agri-Food Canada's Guelph Research and Development Centre. He holds a BSc and an MSc in Microbiology from Ain Shams University in Egypt and a PhD in Food Microbiology from the University of Guelph.

Dr. Anilda Guri is a senior research scientist with Gay Lea Foods, with an MSc in Natural Products and Biotechnology from the Mediterranean Agronomic Institute of Chania in Greece and a PhD in Applied Chemistry from the Agricultural University of Tirana in Albania. She has also completed postdoctoral research on dairy structures at the University of Guelph's Department of Food Science.



# TESTING THE IMPACTS ON ANTIBIOTIC ALTERNATIVES ON PORK QUALITY AND SAFETY

**Project:** Optimizing microbiological quality and safety of fresh and processed pork products

**Industry partner:** Olymel S.E.C./L.P., Boucherville QC

**Principal investigator:**

Dr. Linda Saucier, Ph. D., Agr., Chm., Professor, Department of Animal Science, Faculty of Agriculture and Food Science, Université Laval, Québec QC

Canadian hog farmers are increasingly moving away from using antibiotics in pork production.

To keep animals healthy, they're using alternatives like probiotics that can boost the immune system by promoting better gut health.

There are still a lot of unknowns about the impact that influencing the pig's microbiome will have on the quality, safety and shelf life of pork products. That's why Olymel, Canada's largest pork producer and processor, is working with scientists from Agriculture and Agri-Food Canada and Université Laval on research to gain a better understanding of the links between gut health, food safety and product quality.

"There is very little research on the microbiome and the impacts of using antibiotic alternatives in pork production," explains Dr. Sylvain Fournaise, Olymel's Vice President of Food Safety and Technical Services. "Food safety and public health are a top priority for Olymel so we are committed to doing everything we can to understand and control any potential risks."

With resistance to antibiotics posing a growing threat to global public health, livestock farmers in Canada and other countries are looking for alternatives that will maintain the health, welfare and production efficiency of livestock without compromising food safety.

**The project has three main objectives:**

- Setting a baseline. Through metagenomic testing, researchers will identify the bacteria and bacterial families found in different stages of the value chain in order to determine whether bacteria found in the processing environment or on pork products originate in the microbiome of the animals themselves, or in the production or processing environments.
- Evaluating impact on the gut. Researchers will evaluate the effects of different probiotics on pig gut health and how the addition of probiotics combined with reduction of antibiotics influences the intestinal microbiome.

- Piglet health. Researchers will compare the health and welfare of pigs raised in environments with different health statuses, with or without antibiotics and with or without probiotics, as well as evaluate the meat coming from these animals.

"Consumers today expect safe food and sustainable livestock production that respects both human health and animal welfare," says Fournaise. "At Olymel, we are proud to produce high quality pork products that truly are feeding the world, and research like this is important to ensure we continue to be a global leader in this regard."

## Why is this innovation important?

**FOOD SAFETY:**

Use of antibiotic alternatives in livestock production and a better understanding of the gut microflora improves the safety and quality of meat products.

**HEALTH:**

Using antibiotic alternatives in pork production helps address global resistance concerns in both human and livestock health.

**ANIMAL WELFARE:**

The microbiome is believed to strongly influence overall animal health and a healthy gut can help pigs better withstand disease.



## What does this project mean to Canada's food processing industry?

Replacing antibiotics with more sustainable alternatives will ensure food safety and quality and further minimize the risks associated with antibiotic use in livestock production, as well as confirming Canada's leadership role in this area.

**About Olymel S.E.C./L.P.**

Olymel is one of Canada's leaders in the production, processing and distribution of pork and poultry meats. The company, which employs over 15,000 people, has production and processing facilities in Quebec, Ontario, Alberta, New Brunswick and Saskatchewan. Olymel exports to more than 65 countries and prides itself on the high quality of its products. Its brands include Olymel, Lafleur, Flamingo, Pinty's, Tour Eiffel and more.

**About the Project Team**

Dr. Guylaine Talbot is a research scientist in microbial ecology with Agriculture and Agri-Food Canada's Sherbrooke Research and Development Centre. An adjunct professor at the Faculty of Science, Université de Sherbrooke, she has a PhD in Biochemistry from the Faculty of Medicine and Health Science at Université Sherbrooke.

Dr. Sylvain Fournaise is Vice President of Food Safety and Technical Services with Olymel S.E.C./L.P. He holds an MSc in food science and technology from Université Laval and a doctorate in veterinary medicine from the Université de Montréal.

Dr. Linda Saucier is professor and researcher in the Department of Animal Science at Université Laval. She has a PhD in microbiology from the University of Alberta and an MSc in food science and technology from Université Laval.



# CANADIAN FOOD INNOVATION NETWORK



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