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Canadian*food*Insights

MAKING BACON

Industry struggles to maintain supply and price as deadly virus spreads PG. 34

Regulatory Arena

New regulations governing the billion-dollar-per-year aquaculture industry will focus on increasing sustainable production while protecting the environment. PG. 32

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2

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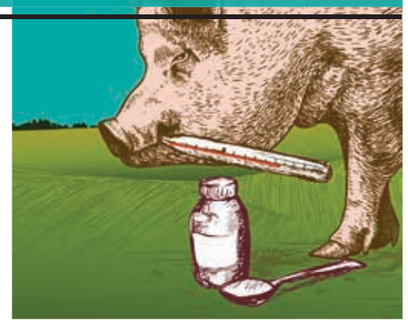
Porcine epidemic diarrhea virus and its implications for the Canadian swine industry

A vaccine is needed to combat the porcine epidemic diarrhea virus as pig farms are getting decimated in the U.S. and pork prices continue to rise. Canada has yet to feel the full force of the virus as it has yet to strike west of Manitoba.



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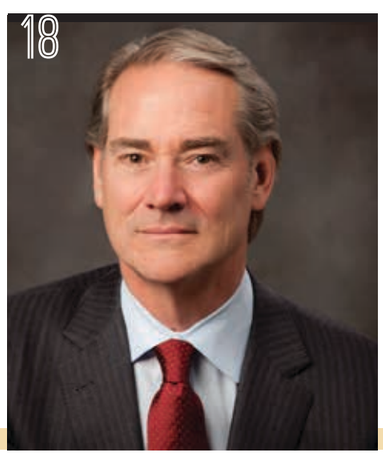

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Nicolas Heffernan

EDITOR FOR
CANADIAN FOOD INSIGHTS

IUFoST Resonates

After countless hours of preparation and worry from CIFST organizers, the food science and technology world descended on Montreal for the 17th IUFoST World Congress of Food Science and Technology in August.

The opening ceremonies kicked off with some interesting speeches which set the table for great debates and discussions during the sessions throughout the four days. But the highlight of the opening ceremonies was the daring display by Carpe Diem, acrobats from Montreal. Watching the athleticism and skill of the performers only served to remind me of my own inadequacies but it was still pretty spectacular to see firsthand.

But I digress.

Although I may be a little bit biased, the congress was a spectacular success. CIFST surpassed its own expectations with just over 1,800 attendees. More impressive than the attendance numbers though were the speakers. I attended at least three panel discussions per day and each one was fascinating. The difficulty was in choosing which discussion to attend.

Going into the congress I was particularly looking forward to the CIFST's Student Challenge. Some of the best and brightest young minds in Canadian food science put on a fantastic show. It seems I wasn't alone though as organizers had to scramble to get more chairs to accommodate the standing-room-only crowd.

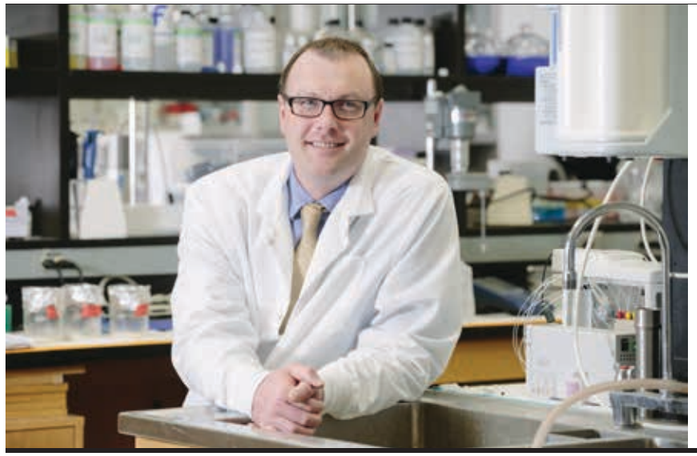
The cherry on top of the whole show was the canned food challenge. The initiative, led by food science and technology students from McGill University in conjunction with Moisson Montreal, a local food bank, obliterated the mark needed to achieve a Guinness World Record, forming a line of 44,966 cans stretching 3.8 km. It was a sea of cans as far as the eye could see.

The theme of the show was *Research that Resonates*. That fits perfectly with a few questions Brian Keating, Deputy Director of the Commonwealth Scientific and Industrial Research Organisation (CSIRO), posed in his role as IUFoST Distinguished Lecturer. He asked, "How do we get food science, agricultural science and health science better connected? And how do we get more connected overall?" A large part of that overall equation is connecting not just different areas of sciences but connecting other stakeholders, especially industry and government, to academia.

If that can be done we might actually hit upon research that resonates.

Sincerely

Nicolas Heffernan



Michael T. Nickerson, Ph.D., P.Ag.
SASKATCHEWAN MINISTRY OF AGRICULTURE RESEARCH CHAIR
(Protein Quality and Utilization)
Department of Food and Bioproduct Sciences
University of Saskatchewan

What a Whopper of a summer to remember, I think I am still reeling after the merger of Burger King with my beloved Tim Horton's, but am content that my maple dip will be protected. The other big summer event was the IUFoST 17th World Congress of Food Science and Technology held in Montreal. *Canadian Food Insights* was there to help celebrate the huge international success co-hosted by CIFST; and where the excellence of our own Canadian industry, researchers and youth were showcased to the world. Congratulations to all!

Building off our previous successes, I wanted to take the time to introduce you to another exciting issue of *Canadian Food Insights,* which I promise to be another big hit. This issue contains an especially relevant review article relating to the pig virus that is significantly impacting our swine industry and consumer pricing, entitled *Basic facts on porcine epidemic diarrhea virus and its implications of the Canadian swine industry.* The article describes characteristics about the virus itself, strategies used to combat the spread of it and the impact it's having on our swine industry. Other review articles relate to the "riches of the sea" with articles on *Salmon aquaculture in Canada* and *Microalgae: Canada's next blooming industry.* The former touches upon topics such as the differences between wild vs. free salmon, the impact of environmental contaminants and veterinary drugs, and the biggest question of 'Why salmon are pink?' for our readers. And further, the microalgae article introduces our readers to some of the value-added opportunities for the food and nutraceutical sectors from a non-traditional source. Our Regulatory Arena section also highlights some of the regulatory oversights facing the aquaculture industry within Canada, to help you swim through all the legal mumbo jumbo. This issue also touches some big and interesting stories across Canada, such as the devastating floods in agriculture-rich Saskatchewan and Manitoba, the push for premier pet food ingredients, alternative protein sources (muskrat – really?), growing food on Mars, as well as other industry and research success stories.

A special thanks to my entire team; our own Editorial Board and Dovetail Communications for continually making *Canadian Food Insights* possible. So please sit back, with a double-double in one hand and a Whopper in the other – and enjoy.

Sincerely

Michael T. Nickerson

food EVENTS 2015

Jan. 29-Feb. 1
Guelph Organic Conference
GUELPH, ON

February 22-24
Annual Meat Conference
NASHVILLE, TN

February
Beef Farmers of Ontario Annual Meeting
TORONTO, ON

February 23-24
Wild Oats Grainworld
WINNIPEG, MB

PEOPLE PROFILE

Home Kitchen to CEO of the Year

SUSAN NICZOWSKI HAS TAKEN SUMMER FRESH SALADS A LONG WAY IN TWO DECADES.

In 1991, Niczowski left her job and started the company with her mother in her kitchen. "I was very fortunate she supported me both financially and mentally and then we started chopping away," she says.

Back then, hummus wasn't exactly filling grocery store shelves. "I had to beg people 23 years ago, literally on my hands and knees, to bring in the Summer Fresh products because they didn't know what hummus and baba ganoush was," she says.

It seems to have paid off. "We've been able to create this category that is growing and is extremely well received both in terms of consumer and retailer response," she says.

In recognition of her success, Niczowski was named the Canadian Institute of Food Science and Technology (CIFST) CEO of the year, in August. "It's an absolute honour," says Niczowski, who found out she won the award when she was on a plane. "When I started 23 years ago I just wanted to create exciting new products and have them well received by consumers and grocery stores and to receive the award is beyond my dreams."

Niczowski attributes a lot of the company's success to the role of food science and technology. Summer Fresh works with good bacteria and good acid levels that are all natural as opposed to a chef who creates based on flavours and taste. "So we kind of work opposite," she says. "Don't get me wrong, the products have to look fantastic and obviously they have to taste great, but we take a different approach."

Summer Fresh also finds unlikely inspiration from fashion to help develop new products. "I always enjoy clothes and there's always something new depending on the season. With food what you eat today, which is fresh tomatoes and cucumber, is not necessarily what you're going to eat in January when it's cold," she says. "So we've got our staples in terms of our products but we always bring out, as in the fashion industry, new products for each season based on the seasonality."

Summer Fresh also needs to stay on top of trends to sustain the product line. "We're always looking, travelling, tasting," Niczowski says. "We have a team that goes out and sees what's going on in the marketplace all over the world and then together we're able to create items that hopefully will be accepted in the North American marketplace. Don't get me wrong; for every success we've had products that have failed as well. It's part of the growing."

Real Canadian Superstore launches Guiding Stars in Western Canada

Real Canadian Superstore locations in western Canada are making it easier for consumers to make nutritious food choices when shopping for groceries by launching the Guiding Stars program in British Columbia and Alberta.

Guiding Stars is an objective, nutrition navigation program, providing at-a-glance nutritional ratings for foods found throughout the store.

The program is designed to complement existing on-the-package nutritional tables and labels, and National Nutrition Guidelines. The program scores food on a three-star scale based on nutrient density using an objective scientific algorithm grounded in current dietary guidelines and the recommendations of national regulatory and health organizations.

"Guiding Stars is a family-friendly tool that translates dietary requirements in a visual and practical way," said Melanie Byland, registered dietitian and Senior Manager, Dietitian Program, Loblaw Companies Limited.

The program scores products on a credit and debit system where foods acquire stars for containing more vitamins, minerals, dietary fibre, whole grains, and omega-3 fats and are debited for containing saturated fat, trans fat, added sodium, or added sugars. Products can earn up to three stars, with ratings displayed clearly on store shelves. Foods with fewer than five calories per serving, like bottled water, teas, and spices, are not rated. If a food has been rated and does not meet ranking criteria it will display no stars.

food EVENTS 2015

February
Canadian Federation of Agriculture Annual Meeting
OTTAWA, ON

February 28-March 1
Baking Industry Suppliers Association Winter Summit
CHICAGO, IL

March 1-3
Canadian Restaurants and Foodservices Trade Show
TORONTO, ON

food EVENTS 2015

March 5-6
Annual North American Food Safety Summit
TORONTO, ON

April 28-30
(SIAL) International Food and Beverage Trade Show
TORONTO, ON

May 19-21
Sweets and Snacks Expo
CHICAGO, IL

President's Choice modernizes message to reflect customer cravings

Loblaw is ushering in a new era for President's Choice.

Canada's number-one consumer packaged goods brand, under the rallying cry CRAVE MORE is encouraging customers to expect more from their food, in an age when Canadians are caring and conversing more about the value, quality, taste, sources, ingredients and excitement of what they eat.

In support of the brand's new era, Loblaw is launching the most ambitious and comprehensive campaign in its history: a modified brand position, an innovative television and print campaign, and a re-imagined digital and social media presence. It has also re-invented its web site, which includes a custom online community for food discussions and a regionalized Canadian food-trend tracker, the Food Pulse Index, created through a new initiative with Google Canada.

"In an age when curiosity and scrutiny surround the purchase and enjoyment of food, President's Choice will remain Canada's most thoughtful and engaged food brand," said Galen G. Weston, Executive Chairman and President, Loblaw Companies Limited. "Today's customer craves more distinct and exotic flavours. They crave more knowledge about what is healthy and what is not. They crave information about where their food comes from and how it is made. And they are engaging every day in passionate conversations about food quality, taste and trust."

The President's Choice team will make Google search insights available with the Food Pulse Index. The index is the first to track food trends nationally and by province, on the basis of Google search insights. Insights will be grouped by theme, search trends will be assessed against thousands of related words and terms, information will be assessed regionally and nationally, and the results will be presented visually and with editorial at pc.ca.

"The President's Choice brand has led and served Canadian taste buds and food interests for three decades," said Weston. "We've never witnessed a time when our role as a food manufacturer and retailer has meant more. The modernization of our brand will mean more food innovation, greater consciousness around product sourcing and ingredients, and a heartier dialogue with Canadians who share our excitement and curiosity."

STING IN THE TAIL

Two of Ontario's largest honey producers, Sun Parlor Honey Ltd. and Munro Honey, have filed a class action lawsuit on behalf of all Canadian beekeepers to recover damages suffered by beekeepers due to the widespread use of neonicotinoid pesticides.

If successful, beekeepers who join the lawsuit could recover losses and damages from as far back as 2006.

The Statement of Claim alleges, among other things, that Bayer (CropScience) and Syngenta were negligent in their manufacture, sale and distribution of neonicotinoids in Ontario that caused beekeepers to suffer significant losses and damage.

These losses include killed or weakened bees; non-productive queens and bee colonies; breeding stock; contaminated wax, combs and hives; reduced honey production and lost profits; costs incurred to meet honey and pollination contracts; and increased labour, equipment and supply expenses. This class action seeks to recover these losses.

"While the Ontario Beekeepers Association is not directly involved in this action, we support any effort that could help beekeepers recover losses caused by the overuse of neonicotinoids", said OBA VP Tibor Szabo. "This Action puts the blame where it belongs – on the pesticide manufacturers."

COMPANY PROFILE

Striking Oil

Text by Nicolas Heffernan

NATASHA VANDENHURK, CEO OF THREE FARMERS, IS ON A MISSION TO EDUCATE CANADIANS ABOUT CAMELINA, AN OBSCURE EDIBLE OIL FROM EUROPE.

"It's definitely been an uphill battle," says Vandenhurk. "Oils are a very hard category for people to understand as it is. There are so many different facets to it, like smoke points and flavours and fatty acid profiles, and people don't really understand that stuff so it's really a process of education."

Three Farmers was started in 2007 after one of her neighbours, Colin Rosengren, came across the camelina seed at a convention in Saskatoon and saw an opportunity to do value adding in Saskatchewan. He approached two neighbours, one of whom was Vandenhurk's father. They decided to grow the seed and after a few years of tweaking, were approved by Health Canada for novel food status. They started selling the original camelina oil in 2010, the same year Vandenhurk became CEO. Her sister, Elysia, is COO and a Red Seal Chef.

Vandenhurk has spent the last four years educating Canadians about the virtues of the oil, which is shelf-stable, has a high smoke point (making it versatile in the kitchen) and offers a rich nutritional profile including vitamin E and omega 3 fats. The seed is also cold-pressed to preserve its nutritional properties. The company is seeing slow and steady results. "This is our fourth year of sales and we've seen very good growth but it's very steady."

Aside from extolling the virtues off the oil itself, Vandenhurk has built Three Farmers on four pillars: value-added agriculture, sustainable production, healthy foods and traceable growing.

"I don't know any other companies that are providing foods nationally that you can go to the website and phone your farmer," says Vandenhurk. "We're shipping off our first container to China and any customer that picks it up there can trace it back to my dad. That, to me, is unique and it's the coolest thing about our brand. That's really our point of differentiation," she says.

The company's focus on natural, sustainable and traceable seems to be serving the company well as Three Farmers recently had to move to a bigger office. An appearance on CBC's Dragons' Den in 2012 certainly didn't hurt. "It was huge for us," she says. "When you're marketing a product that is largely unheard of across the country, it can be pretty hard on the pocketbook so national exposure really did us well."

Despite the company's growth, Vandenhurk isn't looking to move beyond the health food stores where Three Farmer's products can currently be found. "We're definitely not closing ourselves off to [big chain stores]," she says. "It really is a matter of awareness. The awareness of camelina oil is not yet there to have that pull in those mainstream stores. It's just really hard to support those products given the marketing dollars you need to put in and we're just not there yet."

UBC RECEIVES **$2.6-MILLION GRANT** TO IMPROVE DATA ON WORLD FISHERIES

The University of British Columbia's Sea Around Us project has received $2.6 million (U.S.) from The Paul G. Allen Family Foundation to provide African and Asian countries with more accurate and comprehensive fisheries data to help them better analyze and support their ocean resources and local economies.

"This generous support will help UBC fisheries researchers work with countries to better understand the industry's impact on marine ecosystems and its social and economic benefits," UBC President Arvind Gupta said. "The Paul G. Allen Family Foundation is giving our researchers an exceptional opportunity to work with global communities."

The project, led by UBC Fisheries Centre professors Daniel Pauly and Dirk Zeller, will provide comprehensive catch data and data collection methods to policy-makers and nongovernmental organizations working with countries in West Africa, East Africa, the Arab world and South Asia.

"This project is significant for the global fisheries community," Pauly said. "The data collected will help governments make informed national policy decisions by balancing economic growth with resource preservation."

Researchers will help countries use this data to address national policies related to four main problem areas:

- Increased public transparency of access agreements for foreign vessels to fish in a country's waters;
- Improving inadequate methods for recording or estimating fish catches;
- Improving poor policy and management environments for local small-scale fisheries; and
- Illegal fishing by foreign fleets.

food EVENTS 2015

June 3-5
World Pork Expo
DES MOINES, IA

July 11-14
IFT 2015
CHICAGO, IL

October 10
Anuga 2015
COLOGNE, GERMANY

SOBEYS LAUNCHES BETTER FOOD FUND

Sobeys is trying to tackle poor food knowledge in Canada with its inaugural $500,000 donation to Free the Children to co-develop Home Cook Heroes, a National food skills program.

It's the next step in Sobeys' better food journey that kicked off last fall with a partnership with Jamie Oliver. Better Food Fund supports access to and the advancement of better food through donations and partnerships with national and regional charities.

The Fund has three distinct areas of focus: food access through the support of food banks and breakfast programs; research on food-related health issues; and food literacy through nutrition education and cooking skills programs in schools and communities.

"Better food is a gateway to a better life, and we know from our research that the wellbeing of Canadians is threatened by poor food knowledge and lack of cooking skills," said Marc Poulin, President and CEO, Sobeys Inc. "Through the Sobeys Inc. Better Food Fund, we will engage our entire organization – our stores, employees and vendors – in better food initiatives that will make it possible for more Canadian families to eat better, feel better and do better."

"Knowing how to cook fresh food from scratch is an essential life skill – once you know that, you're set up for life," said Jamie Oliver. "I'm really excited that Sobeys is launching its Better Food Fund to share knowledge and skills with the youth of Canada, empowering them to make better food choices and live happier, healthier lives."

The first new program is Home Cook Heroes, co-developed in partnership with Free The Children. This curriculum-based program will provide students aged 12-17 years from across Canada with nutrition literacy, food awareness and basic cooking skills, with the hope of inspiring them to establish a healthier, long-term relationship with food. Supported by a $500,000 contribution from the Fund, this program will reach more than 500,000 young people a year.

Government Announces Mandatory Labelling of Mechanically Tenderized Beef

The federal government announced new labelling requirements for mechanically tenderized beef (MTB) to help consumers know when they are buying MTB products and how to cook them.

All MTB products sold in Canada must be clearly labelled as "mechanically tenderized," and include instructions for safe cooking. The new labels will emphasize the importance of cooking MTB to a minimum internal temperature of 63 C (145 F) and turning over mechanically tenderized steaks at least twice during cooking to kill harmful bacteria that can cause food poisoning. The Canadian Food Inspection Agency (CFIA) will be verifying that labels meet the new requirements.

The government says the change is an example of how it is promoting healthy and safe food choices to consumers and preventing food safety risks as promised under the Healthy and Safe Food for Canadians Framework.

"Without clear labels, it is difficult for consumers to know which beef products have been mechanically tenderized," said Rona Ambrose, Minister of Health. "[This] announcement, along with new industry labelling guidelines we have released, will help Canadians know when they are buying these products and how to cook them. This regulatory change is another step in our government's commitment to make certain that consumers have the food safety information they need."

Health Canada also recently released new industry guidelines to improve safe cooking and handling information on packaged raw ground meat and raw ground poultry products sold in Canada. To be used by retailers, processors and importers who choose to include food safety information on their products, the guidelines provide standards on what information and symbols to include on the label to boost consumer recognition and uptake, and how the label should be formatted and placed on ground meat packages so that it can be easily seen by consumers.

RecordBREAKERS

Text by Nicolas Heffernan

It seems a lot of people gave a damn about the canned food drive at the Palais des congrès during IUFoST 2014.

The campaign, which ran on the slogan, "Give a can... Give a damn," easily set a Guinness World Record for the longest line of cans. The goal was to reach 30,000 but that number was eclipsed with organizers amassing 44,966 non-perishable containers to create a 3.28-kilometre line.

IUFoST organizers wanted an event to coincide with the conference that would go along with the theme of feeding the world. All the food goes to Moisson Montreal, the city's largest food bank, which will distribute the cans to 214 communities.

For Bernice Ting, the student volunteer organizer of the record-breaking attempt, it was the culmination of a whirlwind six months. She was drawn to this project in January as a food science student at McGill. "As food science students we knew the IUFoST Congress was coming to Montreal this year and so we really wanted to be involved somehow," says Ting.

After graduating in April she was able to devote more time to the project but there were times when she worried about breaking the record. "We were collecting cans all the way from March to July so throughout that period there was some, you know, you get those moments where you say, 'Where's the cans?'"

In the end they amassed nearly had one-and-a-half times the amount of cans they needed to break the record. "We can't have such high expectations from the beginning," she says. "Guinness World Record said, 'OK the minimum is 30,000,' so we just went for it."

Ting and the organizers relied on sponsors and donations to reach their goal. About 90 per cent of the project was donated, including 13 km of tape which was needed to bundle the cans in groups of 10 to make it easier for the line to be counted.

In the immediate aftermath of breaking the record, Ting was most proud of the work of the volunteers. "Everybody came together," she says. "Most of the volunteers I didn't know, but they just showed up. Every day I was just so surprised at the numbers that came and everyone just working together."

While Moissan Montreal will benefit from the donations, Ting says having the line of cans on display at IUFost also had another effect. "Part of it is not just giving the cans to Moisson Montreal, but also to bring the awareness," she says. "A large part of why we have this big visual is this is a high-traffic area, this is a public area. I've been here all the days and you see people that really just slow down and take a look and observe the sea of cans and take that moment to remind themselves about the need for this kind of thing."

INDUSTRY Leader SUMMIT

Nancy Quan
Head of Global R&D for Coca-Cola

Philip Donne
Former President of Campbell Company of Canada

Johannes Baensch
Global Head of Research and Development, Nestlé

Jeff Turner
President & CEO, Defyrus Inc.

Text by Nicolas Heffernan

From chocolate to soup and Coke to Ebola, it was a diverse group of speakers and topics headlining the 2014 IUFoST Industry Summit.

Capping the conference's first full day, Nancy Quan from Coca-Cola; Phillip Donne, formerly of Campbell's; Johannes Baensch from Nestlé; and Jeff Turner from Defyrus spoke to a packed room on the theme of the congress: Research that Resonates.

Here are a few thoughts from each speaker about the research going on at their own companies, some challenges to innovation and some tips to succeed:

Nancy Quan
Head of Global R&D for Coca-Cola
We are working on bringing science and technology to enable our global assets so that we can impact the consumers and the communities we reach in a very different way.

Over the next five to 10 years we're going to see the biggest changes in technology that impact our lives than we've ever seen before.

Philip Donne
Former President of Campbell Company of Canada
The next big thing is what's happening with consumers. This is the market if you work for a food company that's going to grow your revenue, that's going to be a future stream of revenue, so we need to think about those consumers as we move forward.

You'll hear in a lot of big food companies that the consumer is king. And I really think there's an excessive cult that the consumer is king because if you blindly follow the consumer, really, you're going to be led down a garden path. There really is this misguided notion that being intimate and understanding the consumer is the true key to success. A lot of you were taught to believe that. I know I was, but in fact because of how much things are changing and morphing, I think that needs to be called into question.

There is an elephant in the room that all the predictive research we've been using over the years still results in an overall new product failure of over 75 per cent. So why are we using it? What have we got to lose?

Innovation requires insight, experience, intuition and importantly, guts – feeling comfortable with the risk that comes with it.

Johannes Baensch
Global Head of Research and Development, Nestlé
Our mission is to be the recognized leader in nutrition health and wellness.

There is no doubt that innovation and renovation is a collective movement. R&D in a way is an enabler too. It's a provider of innovation; it's a provider of designs and technology behind it. But innovation is a collective effort of all functions of the company.

Obviously we have a very strong global R&D organization but by no means does this mean we are working only with ourselves. There are still collaborations with universities on a global basis. We also have a strong collaboration with international partners. We actively drive partnerships meaning it's a give and take partnership. I don't believe in open innovation but I believe in strong partnerships.

When it comes to innovation, it is essential we have consumer centricity and consumer centricity in the modern sense of the word. You need to start with the consumer; you need to understand what the consumer wants. You need to understand what are the drivers and this is a complicated thing. It's obvious you can understand through a 60-40 test. You test your products against the competition with the consumer getting indications where the consumer wants you to go. If you do this consistently and coherently you can even predict better. There's a qualitative advantage to this; there's another dimension to this that's more quantitative.

Jeff Turner
President & CEO, Defyrus Inc.
In order to [innovate] effectively, I urge you to consider these things and consider them seriously because it's been my experience over the last 25 years that it's important to be able to do. First is to find creative inspiration. The second aspect is grit because research isn't easy; innovation isn't easy. Getting it to resonate is even more difficult. It takes a lot of different people. Lastly, I think it's about failure and managing failure. Failure is endemic, you should fail often, you should fail vigorously and in the end, reinforce that success and bring something fantastic to the world.

Rudyard Kipling knew a lot about innovation and he knew a lot about research. He was probably never in a lab in his life but he understood about human nature and his poem "If" talks about innovation. It talks about failing... frequently. It talks about getting up and not bitching about it. You chose this life, you chose to be in the research and development area and you chose to innovate and all the challenges involved with that. And you move forward with that. And those tools seem worn at the time and you work with other individuals and you brought the product forward. And in the end, I think the final message is, if you're successful at this, if you're able to come through and have inspiration, if you have the grit, if you can speak the languages or learn the languages of cross functions and different types of groups, then yours is the earth and everything that is in it.

RESEARCH THAT RESONATES
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Alberta *wins* FOOD SCIENCE TRIVIA

There must be something in the water out west.

The University of Alberta narrowly defeated hometown McGill University to capture the CIFST student challenge at IUFoST 2014. This follows up on the University of Manitoba's victory in the last running of the event.

The universities of British Columbia, Saskatchewan, Manitoba and Guelph, Niagara College (Food and Wine Institute) and the British Columbia Institute of Technology also participated in the event that drew a standing room crowd at the Palais des congrès during the 17th running of the world congress of food science and technology.

Student teams competed via head-to-head trivia and jeopardy style challenges for bragging rights, while showcasing the up and coming talent this country has to offer. When all was said and done, all participants did CIFST proud!

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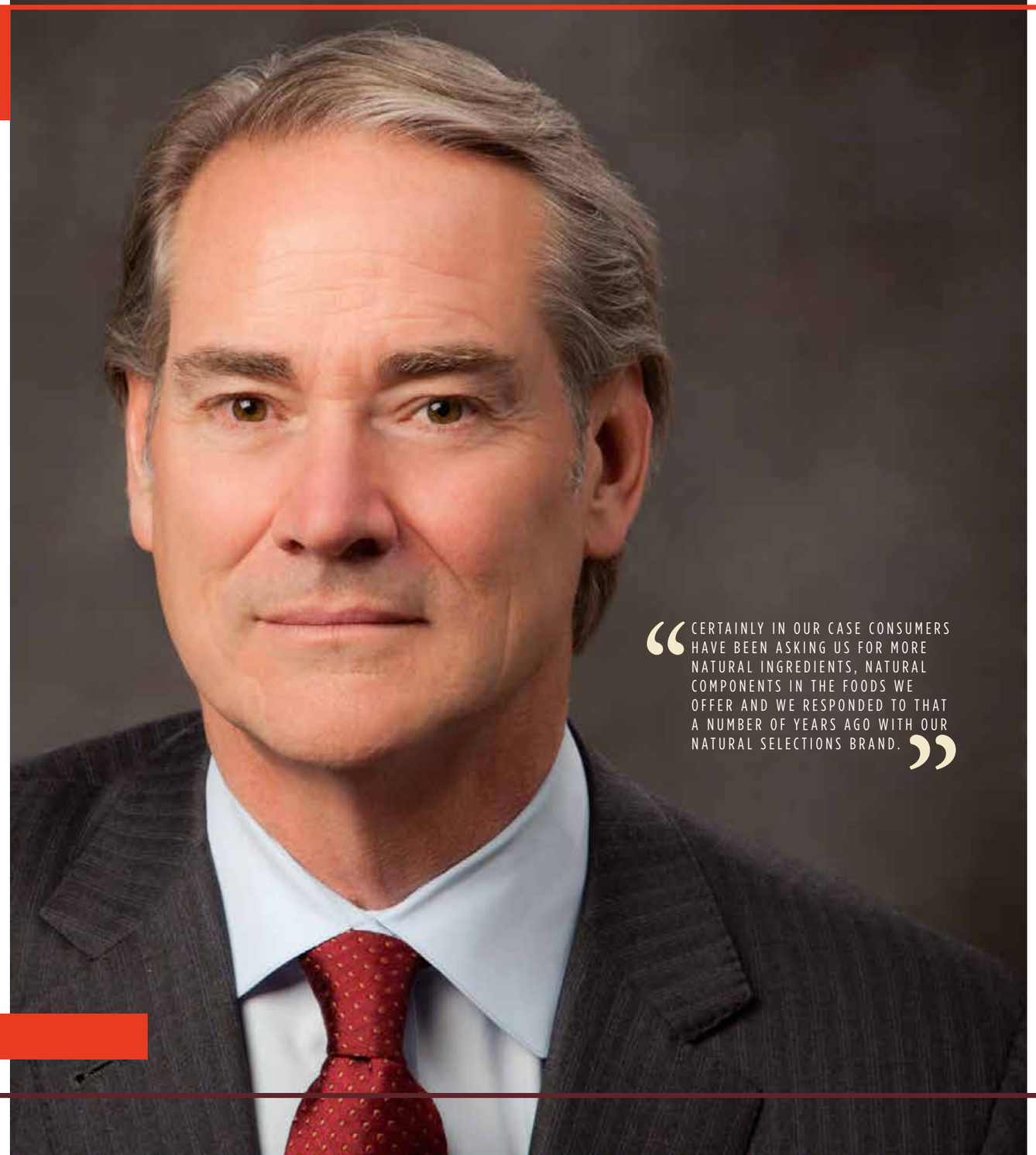
MICHAEL MCCAIN

PRESIDENT AND CEO, MAPLE LEAF FOODS

Michael McCain knows the food biz.

It's been his life, having grown up and worked with his father, Wallace McCain, who started McCain Foods in 1956. Now, as President and CEO of Maple Leaf Foods, McCain is making a name for himself as the leader who captained the company through a tragic food recall in 2008 that resulted in the deaths of 23 people, to the leader now positioning the company for the future. After selling its bread business earlier this year, McCain is busy dealing with that restructuring, the opening of a new, large plant that will see others close, and navigating the waters of high pork prices as the industry continues to deal with the porcine epidemic diarrhea virus (PEDv). *Canadian Food Insights* listened in as McCain spoke at the June Grocery & Consumer Goods Leadership Symposium and caught up with him after the session. Following are edited highlights.

INTERVIEW BY THERESA ROGERS



"CERTAINLY IN OUR CASE CONSUMERS HAVE BEEN ASKING US FOR MORE NATURAL INGREDIENTS, NATURAL COMPONENTS IN THE FOODS WE OFFER AND WE RESPONDED TO THAT A NUMBER OF YEARS AGO WITH OUR NATURAL SELECTIONS BRAND."

What are your thoughts on health and wellness and what challenges does it present food retailers and food manufacturers?

Childhood obesity is the lightening rod issue but obesity in general is an issue. As a food industry participant, whether you're a processor or a retailer, I think our obligation is active engagement of the issue, not resistance to it, understanding it and recognizing that the food industry doesn't necessarily own the whole issue. There are all kinds of lifestyle and economic issues that connect to it but at the end of the day we have to be a participant to the solution. We believe it's not a question of good foods or bad foods or diets and it leads people to a place of awareness and understanding and education about what a healthy diet looks like. The other aspect of the issue is lifestyle.

What are the opportunities for the food industry in this area?

Start with education. I'm involved with a group called the Grocery Manufacturers Collaborative which is five of the largest food companies and retailers in the country and health and wellness is the leading mode of our agenda. We've done some pretty good things around the need to educate consumers around what does nutrition look like. Then we have to take some leadership not just on our intake but on our nutritional offerings. In the last 10 years we've been focused on trans fat and sodium levels and we've taken proactive steps to reduce that and I think the industry has done some really good things there but also recognizing the next frontier in nutritional awareness is sugar.

Maple Leaf has done some work in this area and tried to provide some thought leadership. Has this translated into a competitive advantage?

Any time you plug into a consumer need and if you're proactive and show some leadership, it will translate. Certainly in our case consumers have been asking us for more natural ingredients, natural components in the foods we offer and we responded to that a number of years ago with our Natural Selections brand. It's been an extraordinary success because it's offering consumers something as simple as, 'Here's a product made with nine ingredients, all of which you can pronounce.'

Let's talk about consumer trends. What are you seeing in the marketplace creating an opportunity for Maple Leaf?

We've defined three major themes that are driving the majority of our work. Health and wellness is at the top but also convenience continues to be very important to the consumer. The whole shopping and eating experience has to be simple. Packaging and cooking is a subset of the convenience component. Then there is changing demographics. Every participant in the packaged goods industry has to look at the other components of consumer interest today and what that means. Consumers are either trading up or trading down. They're not staying in the middle. They're either looking for greater add-ins and are prepared to pay more or they're trading down for a lower price so understanding that value equation is important and sustainability is there as well. Consumers are looking for products that reinforce the need to create a more sustainable future.

How is Maple Leaf communicating its brand promise though social media platforms and is the exercise worth it?

Is it worth it? Absolutely, yes. It's part of our marketing journey where it wasn't even five years ago. We use it both in terms of our marketing prospects but also our issues management. In marketing we have committed a reasonable portion of our marketing budget to social media, we've resourced it with people, we have a digital team. In many cases our marketing strategy is oriented to driving people to our social media sites. From an issues management perspective, equally important, clearly if there's an issue we're facing as a company, we're going to address that in a social media context even before we do with conventional media. Being well-armed on Twitter, being able to respond to tweets proactively and factually and actually managing the intensity of these issues on Twitter and responding proactively is our go-to resource for issues management so it's quite a change.

That brings me to a question of crisis management. No one has really forgotten the recall of 2008. You received a lot of credit on how that issue was managed. How do you think things would be different if that were to happen today?

When we had those incredibly tragic events in our history, the 23 victims that died on our watch, which was an absolute tragedy, we tried to deal with that with a sense of accountability and transparency and using it as a call to action to try to bring meaning to such a tragedy: How do we go from where we were, to being a world leader in food safety, which is our journey today. I doubt the substance of the response would change today; the message of accountability. Maybe where we were in a conventional media focus several years ago, probably would have had a materially greater social media component today.

How did that crisis change you? How have you had to evolve personally, as a leader, as your company has grown?

Evolving that leadership model is natural. I think leaders who are not willing to renew themselves on a frequent basis usually don't have sustainability. For me, personally, the obvious is true where you replace intellectual agility with experience and wisdom. Your leadership model has to match the situation that you face. There's no right or wrong and you develop over time more confidence around various situational environments that you might be in. Your emotional intelligence is more important in leadership than your intellectual intelligence. Certainly, that develops with age.

What do people need to be effective leaders?

Emotional intelligence is the cornerstone of sustainable leadership. I don't think it can be taught. I think it's more

an experiential development. My mentor in my life was certainly my father who was a very successful entrepreneur who started running a business in the mid 50s and most of his leadership journey was through that period to the late 80s or early 90s. As much as he was a mentor, today, the organization that I'm involved in is very different than the organization he led. I remember one time screaming into his office to vent and rant as we were going through this massive restructuring and I remember I didn't want a single piece of feedback, I just wanted him to listen and I said, 'I could spend the next six months getting alignment around this organization which could be problematic and it's going to take me six months to get everybody aligned where we have to go.' He looked me in the eye and said, 'Alignment? What the hell are you talking about? I'll tell you how to get alignment. Get in line!' I said, 'Well I'm glad that might have worked for you but it doesn't work for me and it doesn't work for my organization.' Today, organizations are more collaborative, more of a team. The role of a leader today carries the same ingredients of passion and energy and the ability to energize people, deliver results, but today the relationship is different with a leader. It's more about servant leadership, transparency and collaboration and those things probably didn't exist to the degree they do today in the organizations of 30 years ago.

Where are we with collaboration within the retail industry and grocery? How do we make the industry more effective in getting product from you onto the table?

There's a very strategic relationship rooted in collaboration. It has to be transparent, rooted in trust, but it moves the relationship into a space where you can start not thinking about what happens next week or month, but where are we going over the next number of years. Not just how do we trade pieces of the pie, but how do we make the pie bigger and how do we make the pie bigger and more valuable to all of us in the industry? This is thinking strategically and that requires a level of collaboration that didn't exist back in 1979 when we started this.

Are you a takeover target?

We're very committed to the protein business. It's a great business. There are lots of opportunities. We just completed a restructuring journey for the last seven years. We have another six months or year of activity and hard work to complete that. We're really focused on that. We're not focused on anything outside of our world other than completing that transformational journey. Not today. Obviously, as industry participants, we're aware of what's going on in the U.S. Certainly, protein companies in the food space are "hot" today and I think that's reflective of where the consumer is in the sense that protein is really the nutritional profile of choice today and it's recognized in most nutritional circles that protein is not just a valuable, but necessary part of the human diet and that protein consumption is contributing to better health. As far as what's going on in the marketplace, I think in the U.S. there's lots of activity. I see nothing that brings that into the Canadian marketplace. Maple Leaf is not for sale. It hasn't been for sale.

Have you been approached?

No.

Do you know what will be happening in protein given the spike in pork prices and the virus? What's the trend for the next year?

We don't expect the impact of the PEDv virus to be long-term so by next year that will be history. In the short-term we will do our best to avoid raising prices unless we have to but we've been pretty clear with the magnitude of the increase as a result of this particular virus that we were forced to raise our prices at a pretty healthy clip and we've done that and we're trying to keep our heads down and we're pushing through it.

You mentioned sugar earlier. How is the company working to lower sugar in its products?

The good news is, most of our products are pretty low in sugar. We're in the protein business. We've sold the bread business so we're out of the bakery business that maybe has got some greater exposure to sugar-related issues. Having said that, we're sensitive to it. There's obviously product lines where, just like we have in looking at our trans fat profiles and sodium profiles, we will over time, evolve our portfolio in ways that will continue with the nutritional profile and sugar is part of that.

There have been questions about the Naturals line in terms of the claims and marketing of the nitrites. How do you address those claims?

We feel pretty strongly about this that nitrites are a healthy part of the human diet. They are prevalent in the human diet and the human body every day and the highest concentrations of nitrites/nitrates occur naturally in leafy green vegetables, for example. We think, and I think the science supports this, it's one of the great myths of food technology is that nitrites/nitrates are bad for you. In fact, they're required in human digestion. What we've done is convert what occurs naturally, in that line of products, an unnatural version of that which is chemically the same, into what the human diet would consume normally and naturally as a nitrite which happens to be celery extract. So both in terms of food product design and as a marketer, I actually think that's a good thing, not a bad thing, and an important step forward.

Given some of the recent high-profile food manufacturing closures in the country, what are your thoughts on the state of food processing and manufacturing in Canada?

We've been really clear about that both in our discussions with various stakeholders – government, industry, shareholders – the big challenge facing Canadian manufacturing and in particular food processing, is a challenge of scale and technology. We're a small country of 30 million people. We sadly approach that set of facts by taking a small country and making it smaller through regional segmentation which takes something that is the size of the state of California and tries to segment it even further and the consequence of that is our inability to achieve scale in the industries that we operate in. We can't survive in that. As a small country we have to create champions and support large-scale enterprise. What's large to us is actually small on the global scale. We have to support them in ways that recognize there is a direct link between scale, your ability to achieve large-scale competitive operations, and the technology required to complete. We're just completing a facility that we're investing close to $400 million in Hamilton, Ont. A very large facility consolidating many smaller, regional multi-purpose facilities into this one plant across the country. It's a leading-edge facility. It's got the latest technologies and the scale that can compete on a North American basis but it required a lot of resource – time, energy, commitment, courage, financial – to be able to make that investment. The Canadian industry has to recognize that this transition, the historical view of what constitutes a great facility – smaller scale, regional, low tech – can't compete in today's marketplace. It's about scale and technology and those willing to make that investment in Canada will survive and thrive well into the future. We're proud of the fact that we made that commitment.

Is there more that the government could or should be doing to help this industry?

We've had a number of engagements of government basically just to get that message through and I think they understand it. Canadians have a natural desire to be scale-phobic in some ways. It's not a bad thing but it's important to recognize in this world of manufacturing – food or other – scale and technology is the path to success. I think they get it and they understand they have to have a policy framework to support it moving forward.

no ordinary kibble

IN THE WAKE OF RECENT PET FOOD RECALLS, CONSUMERS ARE WILLING TO SPEND MORE ON PREMIUM, QUALITY INGREDIENTS FOR THEIR ANIMALS

Text by Chelsea Shim

Your dog would gladly eat the food off your plate, but would you eat what's in its bowl? Dorothy Hunter would.

Hunter, owner of Paws Natural Pet Emporium is an advocate for all-natural, premium pet food and is willing to put her money where her mouth is. In July, she embarked on a month-long dietary challenge to eat only pet food to promote ingredient awareness. "Consumers need to realize that not all pet foods are the same. They need to read labels," she says. Hunter strictly sells pet foods that are free of corn, wheat, soy, by-products, fillers, preservatives and additives such BHA, BHT, Ethoxyquin and Propylene Glycol.

This is a relatively new phenomenon largely brought about by the widespread pet food recall of 2007.

Contaminated pet food imported from China sickened and killed thousands of cats and dogs in North America, Europe and South Africa. Major companies, including Menu Foods, Hill's, Nestle, Royal Canin and Kirkland, recalled more than 5,300 pet food products. Products that contained gluten and rice proteins contaminated with melamine caused kidney failure in cats and dogs. The U.S. Food and Drug Administration (FDA) alone received consumer reports of approximately 8,500 animal deaths reportedly linked to contaminated pet food.

The result is that for many consumers now, the generic kibble on pet store shelves no longer meets the standards for the modern day pooch. The pet food industry is changing as more companies are heeding consumer demands for healthy, gourmet pet food made with premium ingredients. Human-grade food, locally sourced ingredients, organic products, raw diets, vegan blends and sustainable packaging are just a handful of the consumer needs companies are addressing to stay competitive in the market.

Adrian Pettyan, owner of CARU pet food, a company which produces human-grade pet food, says the 2007 melamine scare from China was the impetus behind the movement toward cleaner pet food. "Although it was a tragedy for pet owners and the pets themselves, it was a turning point to help educate consumers to pay attention to pet food labels," says Pettyan.

WAKEUP CALL

The episode served as a wakeup call for pet owners and the pet food industry has responded. Big box stores like Wal-Mart now carry numerous healthy pet food labels, and multinationals like Nestle are hopping on to the bandwagon with its Purina Beneful Pet Care line. Companies are expanding their product lines to accommodate market demands for higher quality, wholesome and eco-friendly products and reformulating and launching premium, all-natural pet food lines. Some of the ingredient features include a blend of omega-3 and -6 fatty acids that are free of soy, wheat, corn, artificial colours, preservatives and protein by-products.

Consumers are treating pets as members of their families. This is most pronounced among young, urban adults, childless individuals and aging baby boomers looking to fill empty nests; their pets are humanized and treated as surrogate children. Pet humanization views have evolved and consumers prefer to purchase pet products with recognizable ingredients that are similar, or even better, than what they are feeding themselves.

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ACADEMIA INVOLVED

Due to the growing popularity of premium pet food, the University of Alberta received $1.6 million in federal funding to further pet food innovation. The university used the equipment grant to purchase a single-screw pilot extruder, the only one of its kind in Canada, to cost-effectively develop nutritious pet food. The single-screw extruder can process meats, grains and vegetables, and is able to shear cell walls, cook, blend, texturize and shape pet food.

"This extruder is unique because it is much smaller than the equipment found in commercial pet food plants, but is still scalable for commercial production," says Ruurd Zijlstra, an animal science professor at the university who specializes in monogastric nutrition for pigs, dogs and cats.

Small-scale extruders work well for research and final product development. In a commercial

CARU vets each of its pet formula with an animal nutritionist and is branded as a human-grade product.

RETAIL SALES IN THE CANADIAN PET FOOD MARKET ARE PROJECTED TO GROW TO $1.9 BILLION, OR 10.2% BY 2016

pet food plant, product testing is expensive and requires the shutdown of a large-scale extruder with a high production rate. A commercial plant loses approximately 10,000 kilograms of product each day if it closes for product testing.

The pet food industry will benefit from the university's extruder with cost-effective and simple product development. It enables researchers to develop new functional ingredients and test the formulations immediately. The university is working on this project with Champion Petfoods, Alberta Livestock and Meat Agency and Elmira Pet Products.

PREMIUM INGREDIENTS = PREMIUM PRICES

Last year, 57 per cent or approximately eight million Canadian households owned pets. Despite economic struggles and the increasing costs of pet ownership, pet spending has not curtailed. Retail sales in the Canadian pet food market are projected to grow to $1.9 billion, or by 10.2 per cent by 2016. Dog food sales are projected to increase by 11.5 per cent, followed by cat food at 9.8 per cent, according to Agriculture and Agri-Food Canada's Market Indicator Report.

This is good news for manufacturers and retailers because all the premium ingredients consumers are demanding leads to premium prices. High quality pet foods will continue to gain ground in the marketplace. The growing humanization trend means consumers are willing to spend more to improve the lifestyle of their pets.

"You will certainly see a cost increase when the ingredients used are premium and target health benefits. These ingredients cost more. Production costs increase and it is entirely fair to see a segmentation in the pet food market," says Zijlstra.

Sixty-nine per cent of pet owners agreed that they were willing to spend extra to ensure the wellness of their pet. The Canadian Pet Market Outlook 2014, a report published by market researcher Packaged Facts, found that 41 per cent of consumers believe that natural and organic brand pet products are better than standard national brand products.

At the 2012 Global Pet Expo, the number of booths in the show's Natural Pet section increased almost 70 per cent compared to 2011, making natural pet products one of the fastest growing segments in the pet industry.

With consumers placing so much importance on their pet's health, nutrition has become paramount in the food they feed their animal. Pettyan says, "good nutrition for a pet is like buying insurance against sickness."

With consumers placing so much importance on their pet's health, nutrition has become paramount in the food they feed their animal. Pettyan says, "good nutrition for a pet is like buying insurance against sickness."

It's leading the pet food industry in the same direction as human food. "In human foods, we try to eliminate unhealthy fats, preservatives, additives and ingredients that people cannot pronounce let alone, understand. Humans are moving toward a cleaner, natural diet and this is paralleled in the pet industry," says Pettyan.

THE VEGAN DOG

One human trend might be going too far, putting dogs at risk. The pet market is taking a page from human health trends and is latching on to the vegan market. Halo, a holistic, all natural brand of speciality pet food carries a vegan blend that uses plant based protein from green peas and chick peas; the antioxidant rich blend also includes oats, potatoes, carrots and cranberries.

Hunter says vegan diets are intended for pets who suffer from health issues, such as renal failure, that require a low-protein diet, but she has been approached by customers who choose to switch their dog's diet to a vegan blend because of their own preferences. She strongly advises against a vegan diet for pets unless it is warranted by health problems. "Some pet owners disregard this. This is when the trend speaks to the preferences of the pet owner instead of the well-being of animals," says Hunter.

Evidence suggests a dog's body is optimized for eating meat. Pettyan, who vets each of CARU's pet formulas with an animal nutritionist, says dogs are not intended to be raised as vegans. "There is a strong genetic link between dogs and wolves, and wolves are not vegans."

CARU pet food uses only USDA-inspected meat and sources all products, including the added vitamins and minerals, from America. Pettyan provides full transparency to customers, he says the origins of the ingredients used in CARU's stews and pet treats can be traced online.

HUMAN GRADE

Best known for their homemade beef, turkey, chicken or pork stews, CARU's first ingredient is clean protein from muscle tissue followed by vegetables and fruit such as green beans, carrots, apples, sweet potatoes, peas and potatoes.

"We are at the high end of pricing, but you cannot compare CARU stews with canned products," says Pettyan. "It would be comparably priced to freeze dried, dehydrated or frozen premium food."

Pettyan says the higher pricing is reflective of the care and attention put toward producing human-grade food formulas versus pet-grade formulas. "Our whole facility is very different from the typical pet food plant," says Pettyan.

CARU is branded as a human-grade product. To make this claim legitimately, the entire process of handling the ingredients must meet human-grade requirements. Aside from using human-grade ingredients, the facility the food is made in must be a human food plant and all subsequent handling of the food, such as transportation, must meet human-grade standards. CARU meets all of these requirements and is waiting for approval from the FDA.

The stews are packed in Tetra Pak cartons instead of cans, which is a first in the North American pet industry. Unlike cans, the packaging provides resealable convenience to pet owners and is biodegradable, BPA-free and allows for a shelf-stable line without preservative use.

Rather than using the typical high pressure pasteurization method for cooking, CARU uses a gentle cooking process at low temperatures to preserve the nutrients in the food. Pettyan says the stews are produced in small batches to better control the safety of the product. CARU only produces a few hundred packages of stews each minute while the industry standard for canned pet food is 1,200 cans each minute.

The pet food recipe does not use by-products, grains, glutens, artificial preservatives or flavourings.

"Most ingredients eliminated by humans who try to improve their own diets, such as liquid smoke, sugar, unhealthy flavour enhancers or processed foods should also be eliminated from pet foods," says Pettyan.

There is a big movement in the pet food industry and Pettyan says the key is to have a clean ingredient list while maintaining palatability.

Competitors in the pet industry will focus more intensively on pet health to meet the consumer demand. According to data research from The Canadian Pet Market Outlook 2014, higher prices for premium products will be justified by marketers and consumers. "The ongoing market investments of deep-pocketed pet market heavy hitters, as well as smaller entrepreneurs focused on pet health; promise to keep the pet market focused squarely on health for years to come."

Last year, 57 per cent or approximately eight million Canadian households owned pets.

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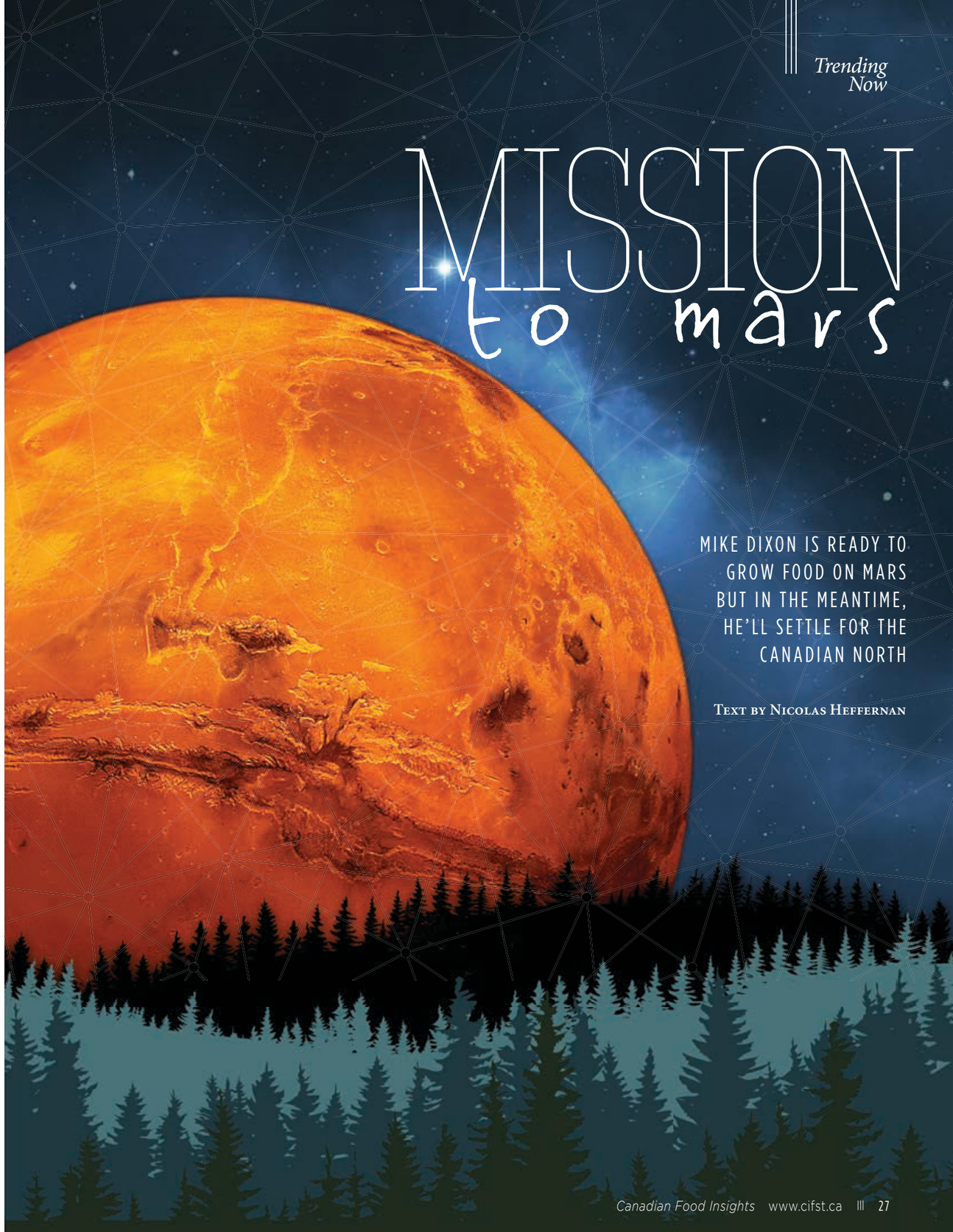
"You will certainly see a cost increase when the ingredients used are premium and target health benefits. These ingredients cost more. Production costs increase and it is entirely fair to see a segmentation in the pet food market."
–Ruurd Zijlstra

MISSION to mars

MIKE DIXON IS READY TO GROW FOOD ON MARS BUT IN THE MEANTIME, HE'LL SETTLE FOR THE CANADIAN NORTH

Text by Nicolas Heffernan



Trending Now

Mike Dixon is on standby: ready and waiting. He just needs a mission.

The professor of environmental biology at the University of Guelph and Director of the Controlled Environment Systems Research Facility (CESRF) has been leading cutting-edge research growing plants in controlled environments. His research is pulled by the goal of growing a plant on the moon, with the ultimate goal of a food system that could support a long-term expedition to Mars.

"We've had the systems engineered and designed and laid out with our collaborative industry group," says Dixon. "We have a road map for Canada to grow the first plant on the moon." Dixon's research has been able to progress to this stage thanks to the rapid improvements in LED technology over the last five years.

But no one is ready to go.

"We could deploy a plant production system on the moon or Mars tomorrow," says Dixon. "We have the technology, we know most of the engineering criteria, we just need a mission. Without a mission there's no money."

In the meantime, Dixon is trying to find uses for controlled systems on Earth, with the food industry poised as a beneficiary.

we could deploy a plant production system on the moon or Mars tomorrow

STARTED WITH A ROSE

Before Dixon contemplated a plant production system on Mars, he was using roses as his guinea pig, collaborating with the Ontario greenhouse industry. "Then that evolved into a desire to explore space applications," he says.

Two decades later, Dixon is highly regarded by the rest of the world and the CESRF represents the world's leading research venue for technology developments in biological life support. "We accidently arrived at that leadership role because everybody else had sort of backed out of it," Dixon chuckles. The Russians were the leaders in the 70s before the Americans took over throughout 80s and into the 90s. "We just happened along at a time when there was a gap in the next generation of technology," says Dixon. "So we kind of took over." With the most advanced technical setup in the world, including the largest hypobaric chamber configuration of any place on the planet as "nobody else would be silly enough to do it," the CESRF attracts researchers from NASA and the Kennedy Space Center as well as the European Space Agency. "We are the home of advancing the technology readiness of systems required for the biological life support challenge," says Dixon.

FOOD TECHNOLOGY TRANSFER

While Dixon's dream is to see the technology used on the Red Planet, its applications for industry is what's keeping his research going. "[The program] is pulled by the technical requirement to go the moon and grow plants but it is driven entirely by the technology transfer propositions for the agri-food sector here on Earth," he says.

While it would seem Dixon's research would be an ideal fit for the agri-food sector, the most successful application at the moment is in the pharmaceutical industry as controlled environments can't compete economically in the food industry yet. "Here in southern Ontario you can be in Leamington and they have 100 acres under glass of one operation growing tomatoes. There's no way [controlled environments can compete]," he says. "They have to have that large a scale of production system because the margin on tomatoes is pennies whereas the margin on herceptin or marijuana is huge so they can accept a certain technical risk and higher level of investment and a faster return."

Thanks to advances with LED lighting, Dixon is much closer to making a real breakthrough that would benefit the agri-food industry on Earth. "Based on the technology as it was five years ago, if you'd have asked me if LEDs would be a viable technical option for artificial lighting in a life support system or in a greenhouse application I would have said no," he says. LEDs weren't technically capable and didn't have the intensity or energy efficiency required but thanks to big market applications, like streetlights, the technology has evolved to such a high level of efficiency that the markets for artificial lighting are getting bigger and the price tag has fallen. "So now we're just at the stage where our desire to apply artificial lighting in an efficient manner to plant production is met by the technical developments in one of the major environment variables which is light."

Dixon's lights can be five times as powerful as the sun – a little excessive as he admits – but they allow him to make mistakes as he tries to find an elusive spectral recipe.

ARCTIC TO THE DESERT

The developments with LEDs have helped advance an idea that could provide a secure, home grown solution to northern Canada's food supply issues. "The north of Canada or the deserts of the Middle East are two venues that have different reasons for pursuing controlled environment food production," says Dixon. "In the Middle East, it's mostly a food security issue. In Northern Canada, it's mostly an economic issue."

While the rest of Canada can rely on its own crops and relatively cheap imports, supplying fresh food to Yellowknife and other remote communities is much more difficult and expensive. Canadian taxpayers subsidize fresh food production to the north through the Nutrition North Canada program (NNCP), which recently replaced the Food Mail program. Under the NNCP, subsidies go to retailers who negotiate freight rates for lower costs. Those savings are supposed to be passed on to consumers. By using Dixon's controlled environments, northern Canada would be able to grow its own food. "You can put horticultural industry sector in that harsh climate that produces enough strawberries as an example to supply that whole market," says Dixon. "If you put a system in there and distribute strawberries throughout the Northwest Territories they're still going to be expensive and they're still going to require some form of direct or indirect subsidy for food but that subsidy is going to stay in the economy of the Northwest Territories."

It would create a new industry in the region that would require some elevated levels of technical competence and expertise, and add another element to the economy. "It's a good plan and we're struggling," says Dixon. "I mean everyone nods vigorously and understands, 'yeah it's a good idea, let's do that.' But it's going to cost a few bucks to figure it out."

Dixon might be getting ignored at home but he's getting some respect abroad. "I had to go to Kuwait to get the funding for the prototype," he says. "They have exactly the same technical solution to their problem. It's plus 50 in the desert in Kuwait. It's minus 50 in the snow bank in Yellowknife and the technical solutions to their food production requirements are almost identical and the LEDs are the key."

FINDING THE RECIPE

The primary problem Dixon needs funding

DIXON MIGHT BE GETTING IGNORED AT HOME BUT HE'S GETTING SOME RESPECT ABROAD.
"I HAD TO GO TO KUWAIT TO GET THE FUNDING FOR THE PROTOTYPE."

Trending Now

DIXON EXPECTS HUMANS TO BE EXPLORING

THE RED PLANET

WITHIN THE NEXT 20 YEARS

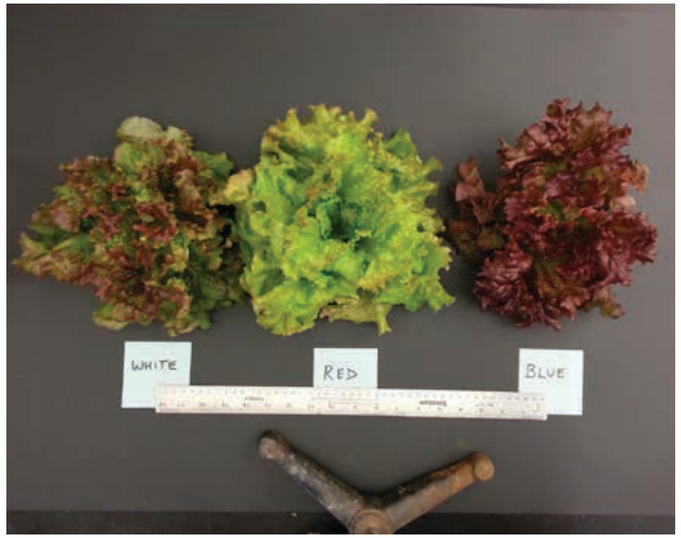
to fix is how to get non-vegetative plants to bear fruit.

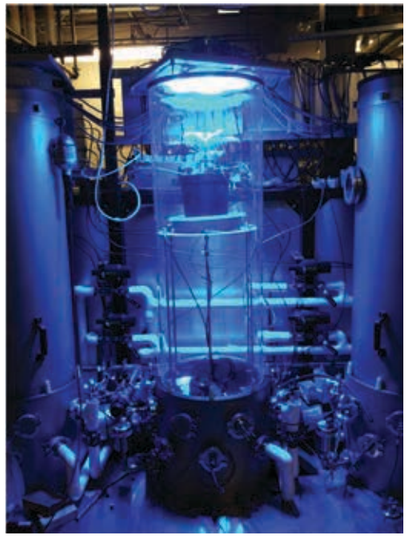
The improvement with LEDs has given rise to a double-edged sword. On one hand, the improvements in LEDs have led to the potential to feed remote communities or grow food on Mars, but now it must be harnessed. "When you have the power to manipulate very precisely the spectral quality of light then you have the responsibility of knowing how to manipulate it. You need to know, 'What's the recipe?' What's the spectral recipe for cherry tomatoes or strawberries?" asks Dixon. "That's a generation of research that needs to be done and so we're just scratching the surface of that now."

Vegetative crops like lettuce and basil are relatively straightforward. "You give it some red and some blue and let her rip and 25 or 30 days later you've got what you need, you have a crop." Fruiting crops are proving rather more elusive. "The environment control challenge is significantly more sophisticated and requires some thought," says Dixon. "We have an educated guess. We know where to start. It's going to be a relatively slow, plodding exercise because imagine the permutations and combinations of even five or six colours." The main stumbling blocks are plants' adaptability and the spectral recipe for each breed can be different.

But Dixon is optimistic given the world class technical capabilities that the CESRF offers, which nobody else can match. The CESRF infrastructure that was created for the space program is perfect for evaluating any environment cocktail but especially lighting, including Dixon's "a little bit silly" LED prototypes. "I can play a tune with the spectral quality of light with my high intensity prototype systems that can generate five times the intensity of the sun," says Dixon, "but it gives me the technical and research capability to make mistakes and break it at both ends and come away with a very valuable recipe of spectral quality."

Despite the hurdles, Dixon's research has come a long way. "We can improve on the sun in terms of a performance of a plant," he says. "You take a plant and put it in your garden, it performs so-so in a conventional manner. I can take that same plant and put it in this controlled environment and after we learn its response to different spectral qualities at different physiological stages then I can manipulate that." He can shorten the plant's time to flower and make it shorter, longer or fatter. "You can do almost anything to it and we're just slowly learning how to manipulate that spectral quality of light and get the reactions from the plants that are good, bad or indifferent."





SPACE DREAM

Despite the potential the technology has on Earth, its ultimate purpose is to support life on Mars.

Dixon expects humans to be exploring the Red Planet within the next 20 years, with missions examining the planet's geology and looking for resources on the surface. In the meantime, Dixon is hoping to go to the moon. "Personally, I'd like to go to the moon first and test drive this stuff because the moon is only three days away and one-week round trip. We can handle that and we can resupply it if we have to and we can make mistakes and learn a few things," says Dixon.

One of the biggest unknowns about growing plants in space is how crops will react when subjected to galactic cosmic radiation. All that would be required is a robotic mission that puts some Arabidopsis plants in a petri dish in a controlled environment about the size of a bread box on the moon. Telemetry on the data would indicate how plant genetics stand up to the radiation bombardment.

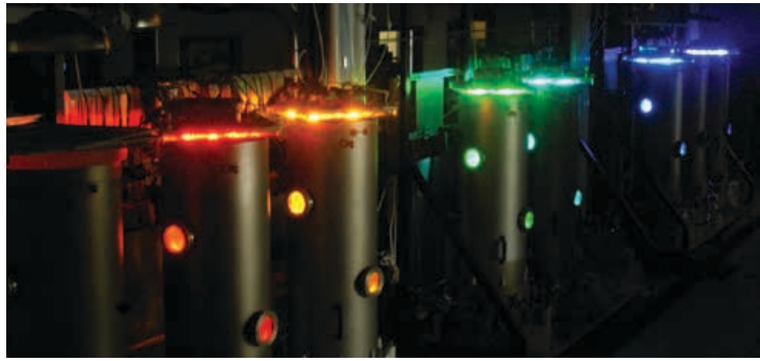
If successful, Dixon wants to incrementally advance the technology using the moon or an asteroid. The International Space Station won't work because it's too close and can be resupplied by a shuttle at a much cheaper cost. "[Controlled environments] are not economically feasible compared to simply sending a bag of flour or a loaf of bread to the space station," he says. "It's more and more feasible the farther away you go."

GOING TO WASTE?

The Red Planet is six months away and a two-and-a-half year return because of the juxtaposition of the Earth and Mars in the solar system so the resupply costs would be prohibitive. "Mass and energy are the currency of space travel," says Dixon. "Not money. Money you spend in the Canadian economy. As an economic engine I can't imagine anything more useful to the Canadian economy than biting off a great big chunk of the space exploration initiative."

The government doesn't see it that way yet. It's been a 20-year battle for Dixon but he's not stopping. "Not in my lifetime but eventually they'll smarten up," he says.

The rest of the world isn't standing idly by. There are programs around the world and Dixon guesses the Chinese will be the first in space with a controlled system. "Canada is just full of lost opportunities," he says. "We're the home of lost opportunities and brain drains. It's entirely possible that we'll screw this up too but we are in a really good position right now. We are deferred to internationally by agencies for specific contributions and exploration agendas. We're just not ready to deliver yet."



Dixon's controlled systems at the University of Guelph is unrivalled in the world.

New aquaculture regulations to focus on sustainability

Sara Zborovski

In this edition of the Regulatory Arena, we focus on the regulation of a particular industry: aquaculture. Aquaculture is the farming of aquatic organisms - fish, shellfish and plants – and it is a billion dollar a year industry in this country.

Not surprisingly, the Canadian aquaculture industry is heavily regulated with science-based environmental and aquatic animal health standards. And, like many other regulated industries, this industry is also facing a time of regulatory change.

The multitude of regulators and regulatory requirements aimed at the Canadian aquaculture industry makes the regime cumbersome for operators and confusing for Canadians who want assurances that environmentally sustainable practices are required by law and are enforced. The Canadian Government has committed to clarifying rights and obligations, and developing aquaculture in a sustainable manner. To do so, it is moving forward with what it is calling a "targeted, pragmatic regulatory agenda" focused on addressing key barriers to industry growth while still safeguarding the environment.

CURRENT REGULATORY OVERSIGHT

Currently, several stakeholder groups work together to conserve and protect Canadian fish and fish habitat: federal, provincial and territorial governments, Aboriginal peoples, recreational fishing and angling groups, conservation organizations and industry groups. These stakeholders share a common interest in conserving and protecting fisheries, and promoting the Canadian aquaculture industry.

At the federal level, industry is primarily regulated by Fisheries and Oceans Canada. This Department is responsible for enforcing a number of Acts and Regulations, including the *Fisheries Act* and its related Regulations. Among other things, these grant authority for fishery licensing, management, protection and pollution prevention.

Other federal agencies oversee other aspects of the aquaculture industry. For example: the CFIA manages and controls animal diseases, including fish diseases, regulates the manufacture and sale of livestock feeds and processing plants; Environment Canada sets standards for mandatory environmental risk assessments; Health Canada regulates drugs for both humans and animals; and Agriculture and Agri-Food Canada is responsible for seafood market development and traceability initiatives.

The provinces and territories also play a role in the regulation of Canadian aquaculture. With the exception of British Columbia and Prince Edward Island, Canada's provinces and territories approve site applications, regulate operations and facilitate industry development. The provinces have powers and responsibilities related to aquaculture management and development and deliver a range of natural resource conservation initiatives under various provincial and territorial laws that complement those of the federal government.

THE FISHERIES ACT

The *Fisheries Act* is one of Canada's oldest laws, having been enacted in 1868. Provisions aimed at protecting habitat and preventing pollution were introduced into the Act in the 1970s, and most recently, in June 2012, amendments were made to enhance the ability of Fisheries and Oceans Canada to manage threats to the sustainability and productivity of Canada's commercial, recreational and Aboriginal fisheries.

Among other things, these most recent amendments include a prohibition against carrying out projects that result in "serious harm to fish" (section 35), provisions for fish passage and flow (sections 20 and 21) and a framework for regulatory decision-making (sections 6 and 6.1). These provisions are intended to guide decision-making to provide for sustainable and productive fisheries.

The amended *Fisheries Act* grants the power to develop regulations to ensure compliance with the new prohibition against actions resulting in "serious harm to fish" and to facilitate regulatory streamlining and increase efficiency across industry. The goal is the development of regulatory tools that will help provide clarity and certainty for stakeholders and staff.

THE PROPOSED AQUACULTURE ACTIVITIES REGULATIONS

One recent regulatory development related to the regulation of the Canadian aquaculture industry is the proposal of the Aquaculture Activities Regulations under the *Fisheries Act*. In line with the overall mandate of the regime, these proposed Regulations are aimed at managing potential impacts to fish and fish habitat related to aquaculture activities, i.e. the deposit of products into Canadian waters. They focus on increasing sustainable aquaculture production while protecting the environment.

The proposed Regulations will clarify conditions under which aquaculture operators may treat their fish for disease and parasites, as well as deposit organic matter. The proposed Regulations will also impose greater public reporting from the industry as well as specific environmental monitoring and sampling requirements.

STATUS AND NEXT STEPS

The next opportunity for public comment will be at the pre-publication of the regulatory proposal in the Canada Gazette, Part I, which is anticipated to occur during the 2014-2016 planning period. In addition, we can expect to see a number of regulatory initiatives such as amendments to the Pacific Aquaculture Regulations.

Basic facts on porcine epidemic diarrhea virus

AND ITS IMPLICATIONS FOR THE CANADIAN SWINE INDUSTRY

Sinisa Vidovic[1] | Bernardo Predicala[2,3] | John R. Lawrence[1] | Darren R. Korber[1*]

BACKGROUND

The rapid emergence of the porcine epidemic diarrhea virus (PEDv) in North America has significantly impacted hog industry operations as well as the supply of market hogs. While known to have caused outbreaks for several decades in Europe and Asia, PEDv was reported in USA hog herds in early 2013, and thereafter in several Canadian provinces in early 2014. The advancing PEDv crisis highlights the potential for highly-infective agents for which there are no pre-existing vaccines to rapidly impact the large scale production of swine, and also emphasizes the potential for emerging pathogens to similarly affect large-scale, food animal industries.

PEDv is an extremely contagious agent spread by the fecal-oral route, causing severe diarrhea in swine and 100 per cent mortality in piglets less than 3 weeks of age. While numbers vary between different reports and because the situation is so dynamic, it has been estimated that between 3-7 million piglets have been lost from hog operations spanning 30 states since the first reports in the US about a year ago[1] resulting in 5-11 per cent lower total annual pork output for 2014[2,3]. This damage to the industry is now being felt by consumers in the form of increased pork prices in grocery stores.

In the absence of a widely-available and effective vaccine, enhanced biosecurity measures constitute the main strategy available to producers to prevent the unmitigated spread of this virus. However, these measures haven't been 100 per cent effective and thus industry experts are still struggling to control PEDv spread. Intensive industry-funded research initiatives are underway globally in an effort to meet this challenge through technological advancement. The PEDv crisis is widely believed to be the most serious challenge facing the hog industry in recent memory. Canadian herds, while somewhat insulated geographically from American herds, are clearly also under threat.

HOG PRODUCTION IN CANADA

Seen as the "second white meat", pork is widely-consumed in many countries around the world as a flavorful meat product with excellent protein and nutrient content. Hog production is a major component of the commercial agricultural animal sector in Canada, with Statistics Canada[4] estimating total numbers of hogs produced for 2013 at 25,000,000 animals. Furthermore, there has been a growing trend in the industry over the past several decades towards a reduction in the number of small hog operations, resulting in fewer but larger remaining operations. This trend has been driven by the economies of scale and improved technologies that enable more hogs to be produced by fewer people while requiring less inputs and resources. In other words, the larger the operation, the more profitable the operation is on a per-hog basis. The potential impacts of PEDv on these large animal operations are similarly large, and in the USA, approximately 5 per cent of the national herd is estimated to have been lost due to PEDv[3].

To date, Canada has remained relatively PEDv-free compared to US hog operations. However, the CFIA (March 3, 2014) reported on their website that PEDv has been confirmed in swine herds in several provinces (i.e., Ontario, Manitoba, PEI and Quebec), and given the extremely hardy and virulent nature of the virus, the agency expects that more cases will be reported from across the country. It is notable that PED does not pose a risk to human health nor to food safety, and is currently not a reportable disease in Canada according to CFIA (note that it is reportable in some jurisdictions, i.e., Alberta); however, the USDA issued a Federal Order on June 5, 2014 requiring the mandatory reporting of swine enteric coronavirus diseases, including PEDv[3]. It is therefore likely that in addition to enhanced surveillance of PEDv and biosecurity measures (see below), national mandatory reporting of the disease may yet occur across all of Canada.

CHARACTERISTICS OF THE VIRUS AND ITS EFFECTS

PEDv is a member of the *Coronaviridae* family of enveloped virus (genus *Alphacoronavirus*), approximately 90-190 nm in diameter, with malabsorptive diarrhea (affecting the ability of the small intestine to absorb water and nutrients) as the main presenting symptom within 1-3 days of infection. Damage and destruction of the microvilli of the small intestine is typically observed upon histological analysis. Suckling pigs present symptoms that include watery diarrhea, vomiting and wasting; almost 100 per cent of infected suckling piglets ultimately die of dehydration. Upon necropsy, the small intestine of infected piglets undergoes extreme thinning, and becomes gas-filled and translucent. Clinically, PEDv is indistinguishable from the symptoms of transmissible gastrointestinal epidemic virus (TGEV), another *Alphacoronavirus.*

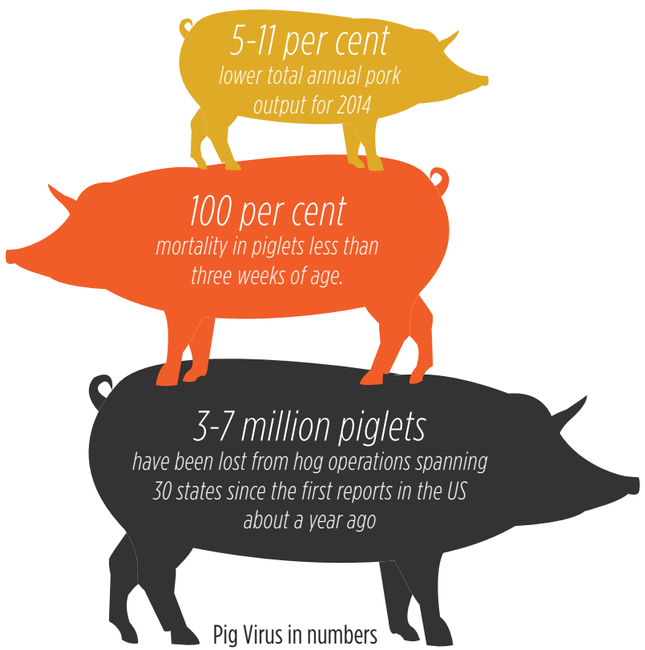
PEDv is a single-stranded, positive-sense RNA virus, with a genome approximately 28 kb in size that contains 7 open reading frames, also known as ORFs, that encode for two replicase polyproteins, four major structural proteins (S (spike), E (envelope), N (nucleocapsid) and M (membrane)), as well as a hypothetical accessory protein. These markers are of critical importance to the PED virus with respect to virus-host interactions, growth adaptation and actual epidemiological status. Detection of PEDv from clinical samples is most rapidly performed using reverse transcriptase real-time polymerase chain reaction (RT-PCR), based on unique genetic sequences within the key structural proteins (i.e., based on the amplification and detection of the nucleocapsid (N) protein gene)[5]. However, improved molecular-based detection methodologies which are sensitive to different PEDv lineages are anticipated to become available.

Work on viral phylogenetics, which focuses on genetic evolutionary relatedness of the PED virus, has indicated that several lineages of PEDv have emerged in North America that appear to be closely related to a strain of Chinese origin deposited to GenBank in 2012[6]. Three US viral lineages, or populations, have thus far emerged. The lineage or lineages that are currently affecting Canadian hog operations are not entirely clear at this time. Knowledge of lineages and their spread will provide greater insights into mechanisms of transmission and progression of this national/international pandemic.

STRATEGIES FOR COMBATING PEDV SPREAD.

PEDv is spread primarily through fecal-oral transmission, although there are concerns that it may also be spread via aerosols[7]. It has also been suggested that a thimble full of fecal material from a PEDv-infected animal contains sufficient virus to infect the entire US herd of suckling piglets[8].

At present, biosecurity strategies are the main barrier against the spread of PEDv since the majority of animals in North America have not been vaccinated (on June 16, 2014, Harrisvaccine, of Ames Iowa, received a conditional license from the United States Department of Agriculture for the company's Porcine Epidemic Diarrhea Virus (PEDv) Vaccine). Given that Canadian pig herds are all immunologically-naïve (e.g., the animals have never been exposed to the virus and hence adult animals have no acquired or innate immunity whatsoever), there exists no passive or active immunological protection. Outbreaks are thus the consequence of the inadvertent direct introduction of infected animals into disease-free herds, or though the indirect transfer of virus via the contact of persons or materials. The role of virus-containing particles, or fomites, in this indirect PEDv farm-to-farm spread scenario is widely-thought to be vehicle mediated however, truck wash stations haven't necessarily been adequate to disinfect truck/trailers exposed to PEDv. Stringent cleaning of hog transport trailers and equipment is clearly necessary to prevent cross-contamination and transmission, and a key barrier to vehicular PEDv transmission includes washing, disinfecting and drying swine trailers. While efficacious disinfectants are available (i.e., a 2 per cent phenol-based disinfectant such as TekTrol, One Stroke Environ, or Pheno-Tek II), their effective application



after spray washing is necessary. Generally, the vehicle/trailer should be dried at elevated temperature after washing to ensure control of the virus (i.e., 160 F for 10 minutes or RT for 1 week). Overall, these measures are impacting the economics of hog transport to various markets.

The search for antimicrobial agents with enhanced efficacy against PEDv has accelerated, and Stalosan® F, which have previously been assessed against the bacterial pathogen *Lawsonia* intracellularis (which causes proliferative enteropathy in swine[9], was suggested as a possible agent effective at controlling PEDv in organically-contaminated material in trailers. However, later tests indicated that protection wasn't complete[10] and hence the search continues. Possible agents currently under investigation include use of nanomaterials as antimicrobial agents that can be incorporated into organic materials and used to treat other critical surfaces (e.g., parking lots, loading bays, etc.) where use of foam and chemical disinfectants and antivirals aren't suitable.

Overarching biosecurity guidance has been provided from various interest groups and governing bodies. The Canadian Swine Health Board has published a National Swine Farm-Level Biosecurity Standard at http://biosecurity.swinehealth.ca/biosecurity-standard/. This is an excellent resource focusing on various direct and indirect routes by which PEDv, and other hog pathogens, may come in contact with swine herds, as well as measures for mitigating these risks. Given that there remains a substantive technology gap for control of this agent, integrated measures are clearly critical. Biological control of PEDv involves vigilance both on and off the farm, and multi-barrier biosecurity approaches that extend beyond the barn are accordingly warranted and necessary. Such biosecurity strategies include tight control over material, animals and animal products, and individuals that enter a hog facility, as well as those areas surrounding barns. This list of indirect contamination routes is in fact quite broad, and in part, includes: incoming and outgoing animal transportation, dead stock, people/workers, aerosols, feed/bedding, fomites, etc. In fact, there exist concerns over those areas frequented by people living and working in the vicinity of hog barns, as indirect contact leading to cross-contamination of individuals and their clothes could also play a role in PEDv transmission. Biological control measures are largely common-sense in nature, and have extensively been reported and reviewed in various trade, industry and scientific publications and venues.

It has also been assumed by various animal health professionals and agencies that acquired resistance by adult animals that were previously infected with PEDv would result in long-lived immunity of perhaps several years or more. However, this appears to not be the case, and while more data is needed, the reinfection of herds that were previously affected by the virus has already been reported in US herds[1].

FUTURE OUTLOOK AND LESSONS TO BE LEARNED.

Clearly, the timely development of long-lived, efficacious vaccines is needed to combat rapidly emerging and highly infectious virus such as PEDv and TGEV. Transport vehicles have been identified as a key vector for viral transmission between geographically widely-separated hog barns therefore, improved sanitation and biosecurity practices, hygiene, and segregation practices during animal transport and delivery to slaughter facilities, are key first points of attention, as trailers/transporters typically service multiple producers. It remains to be seen how rapidly PEDv will spread across Canada, as provinces west of Manitoba are yet to report any cases; the current heightened biosecurity measures seem to be holding the spread of the disease but with potential loopholes already identified, more effort is needed shore up defenses to avoid experiencing a situation similar to that in the US.

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Microalgae:

CANADA'S NEXT BLOOMING INDUSTRY

Andrea Stone[1] | Susan Jorgensen[1] | Nienke Lindeboom[2] | Michael Nickerson[1*]

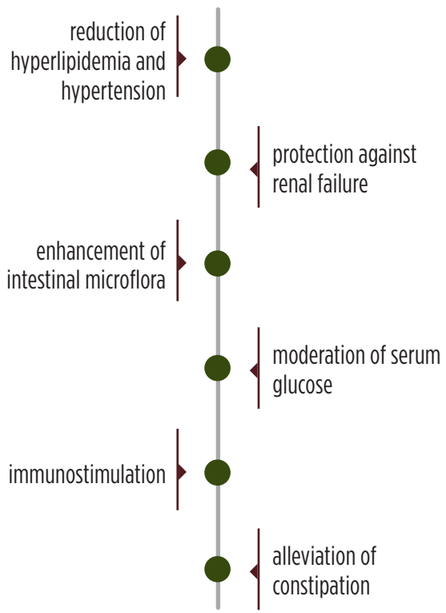
Although relatively unknown, the Canadian microalgae industry is blooming. Microalgae are simple unicellular (photosynthetic) organisms with exceptional growth potential, capable of doubling their biomass within a 24 h period. They can be cultivated in ponds and tanks using water that is unsuitable for human consumption and only need a few key nutrients. Like their growth, their market potential is expanding greatly, as they represent an attractive alternative source of renewable biomass for fuel production. Much of the success and potential of microalgae comes from its ability to produce large amounts of high quality oil, which in some cases can reach up to 75 per cent[1]. To date, microalgae oil has been primarily explored for use in biofuels, since unlike those prepared from agricultural crops, the use of microalgae feedstock does not raise the food vs fuel debate or cause an increase in food prices[2]. However, there is now increased demand for whole microalgae, oil or other nutrients (e.g., proteins, vitamins and pigments) for human and animal consumption[3,4]. Consumption of microalgae and/or microalgae products are currently being investigated for a variety of health-promoting effects including reduction of hyperlipidemia and hypertension; protection against renal failure; enhancement of intestinal microflora; moderation of serum glucose; immunostimulation; and alleviation of constipation[4].

PRODUCTION OF MICROALGAE

The majority of microalgae are photoautotrophic and are grown or produced in raceway ponds and photo-bioreactors. In a typical pond system microalgae is grown in uncovered shallow water that is circulated to prevent sedimentation whereas photo-bioreactors are enclosed artificial environments where microalgae is grown in transparent tubes that are fed from a input reservoir and circulated with a pump[2]. Photo-bioreactors are advantageous in that conditions such as temperature, light, and gas are strictly controlled and a higher concentration of algae is produced, however they are much more costly[2]. Some microalgae species can also grow in the dark using organic carbon as an energy source; cultivation of these heterotrophic microalgae occurs in fermenters and can result in very high lipid production[5]. Once the biomass is produced, microalgae are harvested from the growth medium. Some harvesting methods are species specific, but in general microalgae are removed through either centrifugation or membrane filtration techniques with or without the use of flocculation[6]. After solids separation, further processing is carried out for end use applications. The biomass solids are dried to remove water, and then ruptured through mechanical, chemical, or enzymatic action to gain access to the material of interest[6]. In some cases the dried microalgae is the final product in the form of pellets or powders for human or animal consumption. While these are the traditional methods of harvest and extraction, companies have developed other more cost effective technologies such as pyrolysis of the microalgae biomass to turn it into crude oil and single extraction processes that combine solids separation, dewatering and oil extraction.

MICROALGAE OIL FOR HUMAN CONSUMPTION

Microalgae oil contains a high proportion of the omega-3 fatty acids DHA (docosahexaenoic acid) and EPA (eicospentaenoic acid), which are essential to human health. These oils are



cardioprotective due to their effect on triglyceride levels in the body and have shown positive effects on brain development. While the cost of microalgae-based omega-3s is still higher than fish oil it can demand a premium due to the advantages it comes with, including being from a vegetarian non-allergenic source free from concerns of contamination from mercury, dioxins PCPs and other pollutants. Overfishing and sustainability issues are other consumer concerns associated with fish oil that make microalgae an attractive omega-3 alternative. Another advantage of microalgae is that certain species only contain polyunsaturated fatty acids in the form of DHA which can be useful in applications where EPA is not wanted. Infant formula fortification is a high value market for DHA and contributes to almost half of the microalgae based DHA market[7]. The overall market for omega-3s is still growing and is projected to reach USD 7.32 billion globally by 2020[8] leaving plenty of room for microalgae based omega-3s to expand beyond their niche market.

DEFATTED MEAL CO-PRODUCT

In order to add value to the production of microalgae for oil-based end products, the defatted biomass is being investigated for use in animal feed as it still contains many of the same nutritional components (e.g., proteins and micronutrients, such as vitamin A, B1, B2, B6, B12, C, E, nicotinate, biotin, folic acid and pantothenic acid) as whole microalgae. However, its high ash content (e.g., salts) has so far been a limiting factor. Recently, Gatrell et al.[9] successfully utilized defatted biomass to partially replace corn or soybean meal in poultry and swine feed. The defatted co-product still contains some omega-3 fatty acids and therefore could potentially be used in feed to produce omega-3 rich eggs and milk[10]. However, more research is needed on the digestibility and bioavailability of the defatted biomass in order for success in the animal feed and human markets[11].

OTHER OPPORTUNITIES

As consumer demand for natural food ingredients increases, microalgal pigments are now being used as an alternative to artificial food colorants or for use as supplement powders (e.g., astaxanthin). The benefits of microalgal dyes include their high nutritional value, environmental sustainability and non-toxicity. Microalgae contains a wide range of photosynthetic pigments, comprised of chlorophylls (green), carotenoids (yellow, orange, red), and phycobilins (blue). Pigment production may be controlled through the manipulation of growth conditions, such as in the production of the carotenoid astaxanthin by *H. pluvialis*. An example of a food pigment currently in use is Lina Blue, produced by Dainippon Ink & Chemicals (Tokyo, Japan). It is sourced from *Arthrospira* phycocyanins and is used in chewing gum, frozen desserts, candies, beverages and wasabi[4].

The cosmetic industry has increasingly been using microalgae in high value cosmetic products such as anti-aging skin care emollients, make-up, sun protection, and hair care due to its bioactive compounds such as specific proteins, polysaccharides and pigments[4]. Functional claims include tissue repair, skin tightening, and collagen stimulation[4]. Microalgae are also being used in biopharmaceutical industry for therapeutic protein development. Certain species can act as protein expression systems for the production of recombinant peptides and proteins used in the treatment of diseases such as cancer[12]. It has been shown that microalgae can produce sufficient levels of therapeutic proteins for commercial viability[12,13].

Aside from value-added products, microalgae may be applied in functional roles. Microalgal species have the ability to metabolize water contaminants, allowing wastewater from food and energy production to act as a feedstock[14]. This has obvious environmental benefits, and also may result in reducing the cost of microalgal biomass production, thereby improving the accessibility of applications[15].

INNOVATION IN MICROALGAE RESEARCH

Currently, the majority of innovations in research have been focused on the extraction and refining of high quality oils for human consumption. In addition to the solvent extraction of dried biomass, solvent-free processes, such as cracking through a variety of means in aqueous medium, pulsed electric field treatment and enzyme assisted extraction, are being further explored in order to cost effectively produce these products. The crude oil products can be further refined and in some cases the levels of specific fatty acids are increased through molecular distillation with or without prior esterification. Furthermore, efforts to add value to the defatted biomass are underway, although to a lesser extent, focusing on processing, characterization and product/feed development.

SUMMARY

In recent years the shift from algae for biofuels to algae for food and nutraceutical purposes has occurred. Even though selected Canadian companies have been processing microalgae for nutraceutical purposes since the mid-nineties, the commercial scale production of microalgae for high omega-3 oil, specifically high EPA and DHA, has taken off in the last five years. Several products are currently on the market and even more are under development both in Canada as well as internationally. Besides oil, products such as high protein flour for use as food ingredients and cosmetics, natural astaxanthin and several types of industrial oil are being marketed. The Canadian microalgae industry is predicted to continue to bloom in Canada for years to come. ■

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Salmon Aquaculture in Canada

Tom Gill[1*] | Richard N. Patterson[2]

IMPORTANCE OF AQUACULTURE IN CANADA:

The latest available fisheries statistics[1] indicate that the "farm gate" total dollar value of fisheries in Canada is ~ $2,954,459,000. The aquaculture landings in that year represented a value of $825,457,000 and the farmed salmon landings were valued at $598,845,000 (~72 per cent of total aquaculture). Globally, Canada is ranked 4th in terms of farmed salmon production[2]. Most of the farmed species are Atlantic salmon and grown in British Columbia, New Brunswick and Nova Scotia, with lesser amounts in Newfoundland (Table 1).

Table 1.
Farmed Salmon Production by Province 2012 DFO Fisheries Statistics:

Province	Value ($)	% by Value
Nova Scotia	40,124,000	6.7
New Brunswick	184,966,000	30.9
British Columbia	373,755,000	62.4
TOTAL	**598,845,000**	**100**

NUTRITIONAL ASPECTS:

Globally, aquatic food products account for over 40 per cent of animal foods produced[3]. The health benefits associated with seafood consumption have been well documented and in particular, pelagic species (fatty fish that migrate long distances in search of food, including salmon) which contain the highest levels of omega-3 fatty acids. Consumption of fatty fish has been shown to reduce the incidence of coronary heart disease (CHD) for men consuming one to two servings of fatty fish per week[4,5]. The high content of dietary omega-3 fatty acids (EPA and DHA) plays a major role in heart health and cannot be synthesized in the human body. Other health benefits of omega-3 fatty acids include reduction of sudden death[6,7] and stroke[8,9], improved visual and cognitive development[10,11], alleviation of colitis[12] and rheumatoid arthritis[13], and a decreased likelihood of macular degeneration[14]. Very recently (June 10, 2014), the U.S. Food and Drug Administration and the Environmental Protection Agency recommended amounts of fatty fish consumed by pregnant women to be "at least 8 ounces and up to 12 ounces (2-3 servings) per week of a variety of fish that are lower in mercury to support fetal growth and development"[15]. Previously, the FDA and the EPA recommended maximum amounts of fish that these population groups should consume, but did not promote a minimum amount. Over the past decade, however, emerging science has underscored the importance of appropriate amounts of fatty fish such as salmon in the diets of pregnant and breastfeeding women, and young children. These benefits are additional to the well-known presence of vitamins and minerals commonly found in most seafood as well as a number of other bioactives including a putative peptide(s) from Atlantic salmon shown to alleviate symptoms of type 2 diabetes[16] as well as demonstrating antioxidant properties[17], just to name two additional benefits.

Sadly, the *per capita* consumption of seafood in Canada is very low (~6 kg edible portion/person/year) compared to red meats (~30-40 kg/person/year) and poultry (~30-40 kg/person/year) and many of the most popular species such as haddock, shrimp, and canned tuna have only low levels of omega-3 fatty acids.

WILD VS. FARMED?

The farmed salmon are "true" salmon *(Salmo salar)* or Atlantic salmon. The cultured species are raised from eggs with well-defined genetic composition, first in fresh water and then transferred into seawater where they grow and are eventually harvested before becoming sexually mature. The wild salmon are produced mainly on the Pacific coast and are not members of the genus *"Salmo"*. Commercially-available wild salmon (Coho, Pink, Sockeye, Chum, etc.) are primarily harvested from June to September and contain relatively low levels of fat during winter months when feed is scarce, becoming fatter when feed is plentiful in the summer. As a rule, farmed fish contain much higher fat levels than wild and therefore on a "live weight basis", contain more omega-3 fatty acids. Fresh wild salmon are therefore only available in summer months but readily available year-round as frozen or canned products[18].

About 4.50 kg of living aquatic feed is needed to make 0.45 kg of wild salmon (feed-conversion ratio = 10:1). Farmed salmon need far less feed and are more efficient converters (feed-conversion ratio = 1:1)[18].

Both wild and farmed salmon are considered safe to eat with regard to environmental pollutants, pesticides and mercury content[19,20]; although concerns have been published, a number of studies have shown that the benefits of eating fatty species of seafood based upon the presence of omega-3 fatty acids, far outweigh the risks (see 20 for review).

ENVIRONMENTAL CONTAMINANTS AND VETERINARY DRUGS:

Methyl mercury (MeHg), an organic form of elemental mercury, and polychlorinated biphyenyls (PCBs) are not considered a health concern associated with eating either farmed or wild salmon. The MeHg levels in farmed salmon are estimated to be 0.014 μg/g fish[21], well below the Health Canada guidelines (0.5 μg/g), and far less (~1/70th) than levels found in large predatory species such as shark, swordfish and tuna in which MeHg levels are magnified because these species are at the top of the food chain.

Polychlorinated biphenyls PCBs were manufactured globally until the late 1970's and commonly used as electronic components until that time. They are now banned, having been found to cause cancer in animals and humans. Although a concern was raised in a rather famous study about elevated PCB levels in aquaculture salmon as compared to wild species[22], a Canadian survey[23] of domestic finfish, crustaceans (shrimp and crab) and Canadian shellfish (oysters, mussels) concluded that there were no statistical differences in the PCB contents of farmed and wild salmon and the PCB levels in both were well below the Health Canada guidelines. The cancer risk associated with PCB's in salmon is considered small[19] and the health benefit from the consumption of salmon far outweighs the risks.

Additional concerns have been raised about the use of aquaculture drugs and their residues in the food supply. However, it appears that the industry is heading toward the substitution of vaccines and improved husbandry practices as preventive measures for bacterial infections. Used as directed, the clearance times for these drugs are well-established and pose minimal threats insofar as residuals in seafood.

WHY ARE SALMON PINK?

Carotenoid pigments, specifically astaxanthin, (Ax) and canthaxanthin (Cx) are responsible for the red coloration in farmed salmon and trout. These pigments are produced naturally by aquatic plants (algae) and passed through the food chain to small crustaceans such as shrimp and ultimately to wild salmon, trout and char. Salmon raised in captivity must be fed Ax/Cx-containing diets in order for their flesh to achieve the coloration similar to their wild counterparts. These pigments are identical to those found in nature. The pigment content of the feed is reflected in the depth of colour in the fillet and this is often measured with colour comparison cards or using an instrument called a "reflectance colorimeter". The intensity of the colour is adjusted to suit the consumer, some markets preferring more and some less pigmentation.

Feeding Ax pigment is inefficient (retention < 15 per cent), and because of its significant cost, the mechanism of pigment retention is an important issue and not entirely understood. The salmon pigments do not accumulate in white-fleshed fish (cod, haddock, etc.) regardless of the pigment level in the diet. It has also been shown that once internalized, the pigments bind to only one of the salmon muscle proteins, called alpha-actinin (24). Since all fish possess this protein, this could imply that the difference between salmon and white-fleshed fish is the ability to transport the Ax/Cx from the blood into the muscle cells.

LAND-BASED SALMON REARING

Currently, there is a great deal of research underway for land-based grow-out of farmed Atlantic salmon, thus obviating the negative effects of fish in sea cages. The problems that would be eliminated by land-based aquaculture are:

- elimination or reduction of marine water column and seabed pollution from feed, feces and veterinary chemical waste;
- elimination of salmon escapes from the rearing facility, thereby eliminating interaction between farmed and native salmon;
- elimination of problems with marine predatory mammals attacking net cages and sometimes leading to deaths;
- reduction of the risk of disease and parasite transfer to wild salmon; and
- reduction of the need for antibiotics and parasiticides as treatments associated with raising fish in sea cages.

While growers acknowledge that they can grow fish on land (they do that now from egg to smolt), the energy costs of land-based aquaculture are high (see CBC News posting 1 May, 2014 "Land-based aquaculture isn't commercially feasible, says Cooke").

There have been at least two major government studies on this subject in recent years: one by a Parliamentary committee[25] and one by the Department of Fisheries and Oceans[26]. Although

at the present time, it is difficult to predict whether or not land-based salmon farming can become a reality in Canada, Summerfelt and Christianson[27] described a land-based feeding trial in which 23 tonnes of mature disease-free Atlantic salmon were brought to an average weight of 4.3 kg in 22 months and to 5.6 kg in 27 months. This trial used very low salinity and fish were sold commercially at an undisclosed price.

The Nagamis First Nation of Vancouver Island has reported on their successful "Kuterra" land-based RAS salmon farm that is now operational and aiming at a production volume of 450 tonnes/y at an estimated production cost of $4.77/kg. The fish will be marketed as a premium product using no antibiotics or pesticides. The current farm gate price for "head on", gutted Atlantic salmon in Canada is approximately $6.00/kg but this is an international commodity and so other markets will affect the farm gate value.

SUMMARY

The demand for seafood based on aquaculture is increasing steadily on a global basis as landings of wild stocks have reached a plateau and with rising fuel costs, harvesting of wild fish is unsustainable in the long term. Farming salmon affords the advantages of providing a constant supply throughout the year, at a reasonable cost, and with consistent quality and high nutritional value. There is little doubt farmed salmon is the most available natural resource of omega-3 fatty acids so important for cardiovascular health. However, the farmed salmon industry is rapidly changing, and for the better! Although farmed salmon are much better feed converters than any of their terrestrial counterparts (poultry, swine and beef), the industry has traditionally relied on marine aquatic resources for feed ingredients (fish meal and oil). The current research is focusing on sustainable land-based grow-out systems using plant-based diets and a recent report from the Norwegian Institute of Food, Fisheries and Aquaculture Research (Nofima) suggests that the use of marine proteins and oils is declining; currently, about 50 per cent of the feed ingredients in Norwegian salmon diets are plant based (vegetable protein and oil). The Canadian salmon aquaculture industry has survived globalization and must now compete with countries with lower labour costs and in some cases lower feed costs. In order to compete in the future, the Canadian industry will rely on science and technology to remain competitive and sustainable. Advances in fish nutrition using plant-based feeds and feed ingredients will play a large role.

In addition, as mentioned above, some recent studies at Canadian universities have shown that it may be possible to manufacture bioactive peptides as by-products from the farmed salmon industry and perhaps marketed as nutraceuticals. Such products could no doubt improve profit margins for aquaculture production. To date peptides prepared by the hydrolysis of farmed salmon muscle have been shown to display antioxidant activities with the ability to scavenge free radicals (superoxide and hydroxyl), chelate iron and inhibit linoleate auto-oxidation[17]. In addition, a low molecular weight fraction from the proteolytic digestion of farmed salmon waste has been shown to have anti-diabetic properties and may have applications to the treatment of type 2 diabetes, being able to reverse the effects of insulin insensitivity[16].

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RAIN ON THE PLAIN

HEAVY RAINFALL HAS SEEN THE SECOND FLOOD IN FOUR YEARS ON THE PRAIRIES, LEAVING PROVINCES AND FARMERS LOOKING FOR SOLUTIONS AND CONSUMERS ON THE HOOK WITH HIGHER PRICES

"WE'VE LOST A NUMBER OF ACRES THIS YEAR. THIS YEAR, THOSE LAKES HAVE RISEN OVER 36 INCHES AND OVER THE LAST 10 YEARS THEY'VE RISEN CLOSE TO 22 FEET. IT JUST KEEPS EXPANDING."
–Norm Hall

Text by Nicolas Heffernan

Norm Hall's family carved their farm out of the bush on the southern shores of the Quill Lakes in Saskatchewan 133 years ago.

He's been working the land himself for more than three decades, but thanks to a summer of flooding and a decade of excess moisture he has a little bit less land to farm now. "I used to proudly say I was on the south shore but I'm in the south shore now," he says. "We've lost a number of acres this year. This year, those lakes have risen over 36 inches and over the last 10 years they've risen close to 22 feet. It just keeps expanding."

As President of the Agricultural Producers Association of Saskatchewan, Hall is well aware of the plight of many farmers in the Prairies. More than 100 communities in Saskatchewan and Manitoba were forced to declare states of emergency, and more than 1,000 people in both provinces had to leave their homes thanks to flooding this summer. The floods spared large metropolises but agriculture was hit hard. Manitoba's preliminary assessments estimate the damage at $200 million, while other assessments peg the damage at $1 billion. Approximately 600,000 seeded acres were destroyed and an additional 985,000 unseeded acres were ruined. Manitoba has already paid out $63 million in crop insurance claims. Saskatchewan doesn't have numbers available yet.

The scope of the disaster prompted Manitoba Premier Greg Selinger to declare a province-wide state of emergency. Troops and volunteers were deployed to fill hundreds of thousands of sandbags to shore up flood defenses.

MORE THAN 100 COMMUNITIES IN SASKATCHEWAN AND MANITOBA WERE FORCED TO DECLARE STATES OF EMERGENCY

A one-off situation would be bad enough, but the summer floods come on the heels of the devastating flood of 2011, which caused about $1.3 billion in damages, making it the second-costliest weather event in Canadian history following the 1998 ice storm which toppled trees and caused major outages throughout Eastern Canada. "It's not as bad as it was in 2011 but anytime a farmer loses production of crop and hay it's a challenge because they have to find alternative sources and when you have to find alternative sources there's an expense that goes along with that," says Ron Kostyshyn, Minister of Agriculture in Manitoba.

The flood emergency this summer was different than in 2011. Rather than a spring melt, the trigger was several days of torrential rain as a slow-moving system all but parked itself over the region, drenching it in more than 200 mm of rain. "I often say this tongue in cheek; Manitoba is kind of a bathtub of a water shed that starts in the Dakotas," says Kostyshyn. "The bathtub is filling up and the outlets are somewhat flowing at maximum."

Eastern Saskatchewan and Western Manitoba were hardest hit by excess moisture over the last few years. "There are areas in the western half of [Saskatchewan] that have a fair bit of water but for them that's a novelty and I use that word lightly," says Hall. "It's just something they're not used to. They're not at all amused. The east half of the province... just keeps getting worse and worse."

"In certain areas of the [Manitoba] it would be safe to say there have been three or four years of challenges of excess moisture that's made it very difficult for livestock and grain production," adds Kostyshyn.

While it's still too early to gauge the final damage, the flood has impacted the entire agri-food system in the provinces. Farmer's markets have felt the repercussions as have hay and forage production. The beef industry is paying the price with increased transportation costs and crops that would have been used as feed for turkey and pork feed have been lost. "It's kind of a domino effect," says Kostyshyn. "Without a doubt it will [affect the food supply]. Shortage will create more cost and everything else will increase the cost to the consumer when we talk about food."

WET CYCLE

As little as 15 years ago, the Prairies were in the midst of serious long-term droughts. Dave Sauchyn, a professor at the University of Regina, has collected 8,000 wood and tree core samples to get a sense of weather patterns in the Prairies over the last millennium. The data suggests the Prairies typically see wet and dry cycles lasting decades. These cycles tend to coincide with short- and long-term trends in currents and temperatures in the Pacific Ocean. "Dave Sauchyn said it's a good possibility we're in the middle of a 20 to 25-year wet cycle," says Hall. "So a lot of us that are planning on farming for the next 10 or 15 years, yeah we're going to have to get used to it."

If the excess moisture continues, it could render modern farming methods and tools useless. "A lot of Western Canadian agriculture has been based on us being a semi-arid climate," says Hall. "Now we may have to go back to the old tillage methods to try and dry the land out."

Both provinces are working on ways to mitigate the impact and damage floods cause. "Our government is being very proactive to develop a system that we need, to develop a secondary outlet at the bottom of this bathtub," says Kostyshyn. "We're in the process of obtaining some alternative choices of movement of water out of Lake Manitoba into Lake Winnipeg so it minimizes the reverse domino effect of overland flooding." Manitoba is in talks with the federal government about implementing a control structure. "With their blessing we can look at a control structure and have a relief valve, if I may use that terminology, for minimizing continuing flooding that we experienced in 2011 and 2014."

The data suggests the Prairies typically see wet and dry cycles lasting decades. These cycles tend to coincide with short- and long-term trends in currents and temperatures in the Pacific Ocean.

Their neighbours already have a few structures in place like the Diefenbaker Dam in the Saskatchewan River, which is a power generator but also a flood mitigator, as well as the Rafferty and Alameda Dams in the Souris River. There's nothing in place on the Qu'Appelle or Assiniboine Rivers, though. "We've talked about the long-range plans of flood mitigation by putting controlled structures in these larger river systems," says Hall.

COMPLEX ISSUE

Exacerbating the problem is farmers are draining the land. With the prairies being so flat, water tends to sit on the land for three or four days before eventually disappearing, but by that time, crops have been ruined. It's led to farmers draining their land which has sent the water downstream where it either ends up in water basins like the Quill Lakes or it ends up going through Manitoba's lakes and river systems before eventually ending up in Hudson Bay. "We've talked to the province at least in Saskatchewan, about as this water sits on producer's land it's costing those producers money and if they drain the water they're sending that water downstream and costing someone else money," says Hall. "Now if we're to keep it on our land, that land is ours, it's deeded, it's considered above high water, do we get paid for that? And is there a social benefit to keep this water on our land as opposed to sending it downstream?" The provinces are also working together to devise a solution. "In Manitoba and Saskatchewan, water agencies are working on either drainage plans or in Manitoba's case, they're putting a moratorium on any more drainage," says Hall.

Saskatchewan is also in the midst of bringing forward a 25-year water plan. "I think there's another three or four years of water programs," says Hall. In the meantime, Hall is a part of the Assiniboine River Basin planning commission. "Right now it's just a planning group to try and get enough people and resources together to make this thing fly," says Hall. "That would be to aid the smaller watershed authorities that are within Saskatchewan and Manitoba."

RELYING ON MOTHER NATURE

The worry after two devastating floods in a short amount of time is this might be becoming the norm. "If we get a drier season next year for the most part we'll be able to handle it all, but if we get a normal or above normal rainfall next year it's going to continue in the same cycle," says Hall. "We've been above average rainfall for the last seven or eight years and the water levels just aren't going down in our part of the province and in Western Manitoba."

Kostyshyn won't predict what next year will bring.

"Being a farmer and rancher for 35 years of my life, regardless of whether you go back 50 or 60 years, Mother Nature has always been a challenge that you can never predict."

Approximately 600,000 *seeded acres were destroyed*

An additional 985,000 *unseeded acres were ruined*

Manitoba has already paid out $63 million *in crop insurance claims*

MUSKRAT IS SERVED

JEFF MORRISON'S NEW COOKBOOK URGES CANADIANS TO USE ALTERNATIVE PROTEIN SOURCES... LIKE MUSKRAT

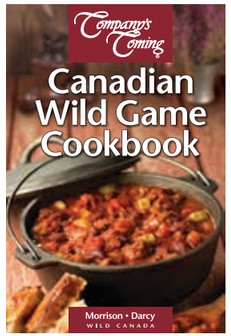
Text by Hermione Wilson

Nature columnist, blogger, author, wildlife enthusiast and self-professed outdoors guy Jeff Morrison spends a lot of time in the great Canadian wilds hunting, trapping and fishing. Growing up in rural Quebec, Morrison spent a lot of time hunting with his family and living close to nature. That upbringing developed strong ideals of conservation in him and a desire to engender an appreciation for wildlife in others.

Morrison currently resides in Ottawa where he writes a popular blog for the *Ottawa Sun* and is a regular contributor to several Canadian and American publications. Armed with a background in environmental management, fish and wildlife biology, and a love of wild game, Morrison has authored several cookbooks featuring recipes for foods found in nature. His most recent contribution, *Canadian Wild Game Cookbook,* is peppered with anecdotes, wildlife facts and several recipes featuring, of all things, muskrat.

WHERE DID YOUR LOVE OF HUNTING AND THE OUTDOORS ORIGINATE?

I think it had something to do with growing up in a town of 300 people. Growing up in the country and the mountains, hunting was a family tradition for the Morrisons.



HOW DID YOU GET INTO COOKING WILD GAME? DO YOU USE FAMILY RECIPES OR COME UP WITH YOUR OWN?

A lot of them were passed down from family, stuff that we came up with at hunting camp. Growing up in [a family-owned hotel], I saw my dad serve some game dishes and at my uncle's famous steakhouse – Alfred's Beefeater – which served game dishes on occasion, including an annual Hunter's Supper featuring a wide range of game meats, I was exposed to cooking deer, moose, bear, wild fowl, upland game birds, and other local wild game. Writing cookbooks was purely by accident. Following the release of my first book, *Weird Facts about Fishing,* my publishers were contemplating a series of outdoor-style cookbooks. They approached me to see if I had experience with game recipes, cooking wild proteins, and outdoor camping, which I did, so it went from there. Next spring my Canadian Berry Cookbook will hit bookstores.

WHAT ARE THE ADVANTAGES OF EATING WILD GAME OVER FARM-RAISED MEAT PRODUCTS?

The most natural food you can eat is game meat. People are reluctant to try it, though, because of the stigma surrounding hunting. Animals that are raised in captivity are largely inactive, so they contain a lot of fat. Wild game is leaner, for obvious reasons. Game meat is really the healthiest protein you can eat.

WHAT ARE SOME TIPS TO KEEP IN MIND WHEN COOKING WILD GAME?

Game meats are low in fat, so low and slow is what I usually say. Since game meats are inherently low in fat, they tend to dry out quickly when cooked. You'll notice several techniques and strategies in *[Canadian Wild Game Cookbook*] for trying to retain the natural juices.

WHAT IS YOUR FAVOURITE WILD GAME OR WILD GAME DISH?

Anything with moose in it. As aesthetically unpleasing as people find them, they're delicious. Wild game usually takes people by surprise. It's very gamey, very strong in taste. Moose is more mild.

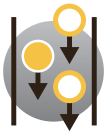
ANY ANIMALS YOU WOULDN'T CONSIDER EATING?

When I was five, my father offered to cook me some beaver meat. At first I was apprehensive, but when I tasted it, it was delicious. They say porcupine is the easiest animal to harvest in the wild, in terms of outdoor survival, and the meat is good, as long as it's well-cooked.

ARE THERE ANY RECIPES IN YOUR COOKBOOK THAT MIGHT SURPRISE PEOPLE?

People might be surprised to see muskrat. I think people will be surprised to find that muskrat is delicious and very versatile. I have recipes in the cookbook for muskrat chili, slow cooker muskrat stew. It's all about perception.

Titration



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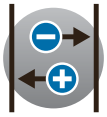
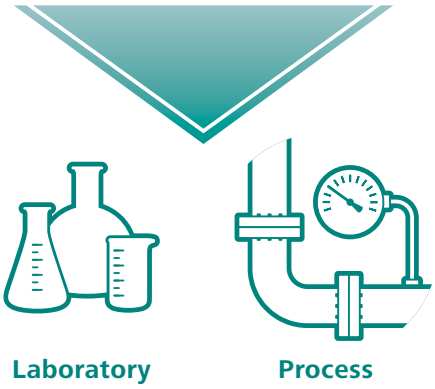


Electrochemistry

Spectroscopy



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