



UNIVERSITY OF ALBERTA
DEPARTMENT OF AGRICULTURAL,
FOOD & NUTRITIONAL SCIENCE



WENDY WISMER

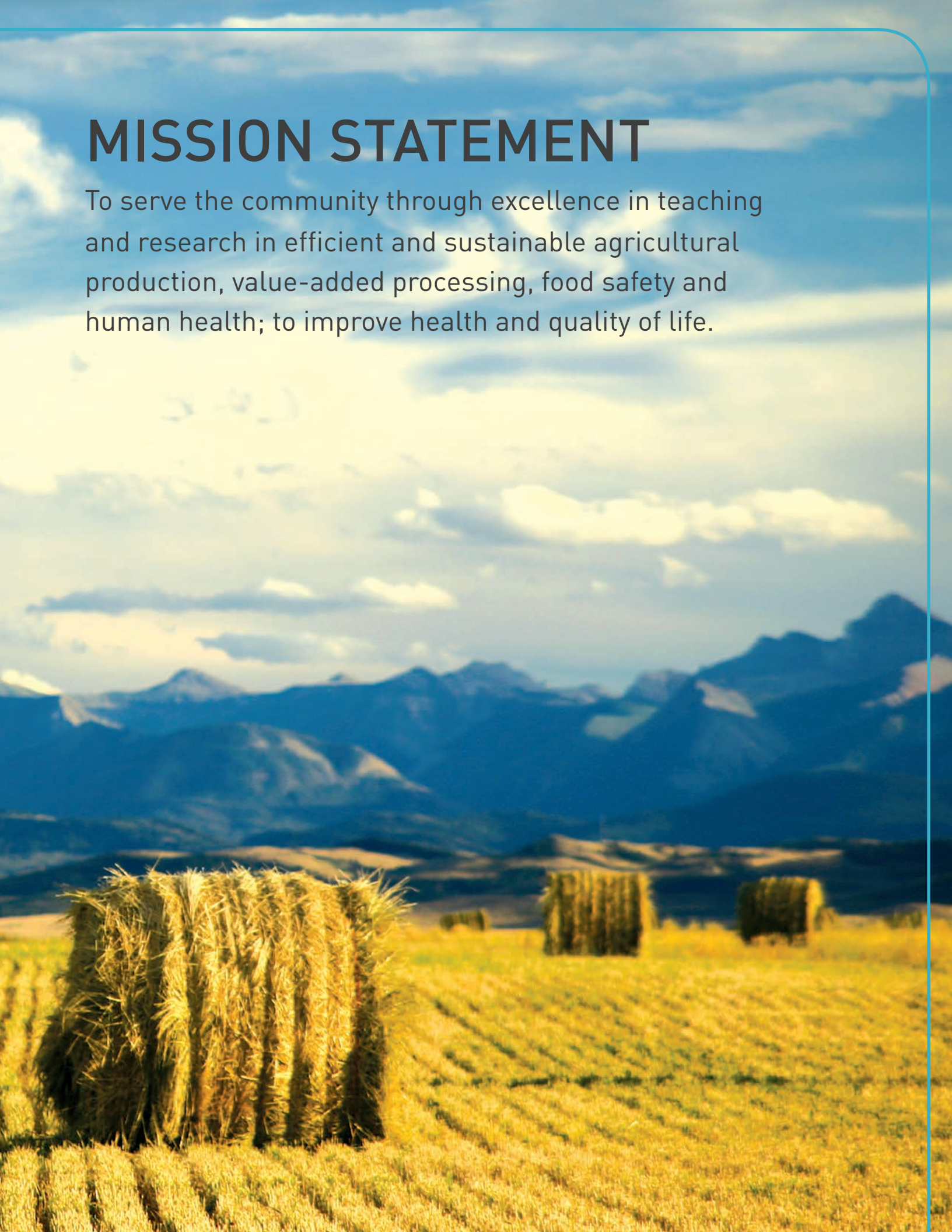
2018-2019

ANNUAL REPORT



MISSION STATEMENT

To serve the community through excellence in teaching and research in efficient and sustainable agricultural production, value-added processing, food safety and human health; to improve health and quality of life.





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MESSAGE FROM THE CHAIR



With pleasure, we present the **2018-19 annual report for our Department of Agricultural, Food & Nutritional Science (AFNS)**.

Our department had another excellent year as we continued to provide solutions that are based on solid science and have had an impact on Alberta, Canada and the world. Highlights for this year include fractionation and sensory technologies to enhance food products, relationships between nutrition, diabetes and celiac disease, tremendous progress in wheat breeding and in disease resistance for canola, and advances in cattle and poultry research to enhance sustainable production systems.

Our success is built on our excellent faculty and staff who continue to teach and train students and post-doctoral fellows. Together, they conduct leading-edge research and teaching, with the support of our many partners, including NSERC, CIHR, Alberta Agriculture and Forestry, Alberta Health Services, Alberta Innovates, Genome Alberta/Canada, and industry partners who have funded research projects and strategic initiatives such as the Livestock Gentec and the Poultry Research Centre and who committed to funding NSERC-Industrial Research Chairs.

Indeed, AFNS's commitment to excellence is seen in the strength of our education and research programs, partnerships and connections with our community, and in the impact of our amazing students who continue to win competitive scholarships and awards. Our education programs continue to evolve – for example, our accredited dietetics specialization program that trains future registered dietitians and our updated animal health program and animal science major that were reviewed together. Our future is bright as our undergraduate student numbers remain strong, especially for the nutrition and food science and agriculture/animal health programs.

In this report, we share some of our newest stories. We look forward to continuing to work with all our partners to provide solutions that have a local and global impact.

Sincerely,
Ruurd Zijlstra

Chair, Department of Agricultural, Food & Nutritional Science



ANIMAL SCIENCE

JUDD AIKEN *Prion Disease* **DIVAKAR AMBROSE** *Reproductive Physiology and Management*
BURIM AMETAJ *Ruminant Nutritional Immunology* **DAN BARREDA** *Immunology*
URMILA BASU *Manager, Lab and Genomics and Proteomics Unit* **CLOVER BENCH** *Applied Ethology/Animal Behaviour*
HEATHER BRUCE *Carcass and Meat Science* **WALTER DIXON** *Molecular Biology*
MICHAEL DYCK *Reproductive Physiology/Biotechnology* **CAROLYN FITZSIMMONS** *Beef Genomics*
LEANNA GRENWICH *Director Animal Care* **LELUO GUAN** *Functional Genomics and Microbiology*
DOUG KORVER *Poultry Nutrition* **CHANGXI LI** *Bovine Genomics* **MASAHITO OBA** *Dairy Nutrition and Physiology*
GRAHAM PLASTOW *Animal Genomics* **FRANK ROBINSON** *Poultry Management/Physiology*
MICHAEL STEELE *NSERC IRC, Ruminant Nutrition* **PAUL STOTHARD** *Bioinformatics* **RICHARD UWIERA** *Veterinary Pathology*
CRAIG WILKINSON *University Veterinarian* **BENJAMIN WILLING** *Canada Research Chair, Epigenomics/Nutrigenomics*
JAY WILLIS *Manager, Research Stations* **RUURD ZIJLSTRA** *Ingredient Evaluation and Carbohydrate Nutrition*
MARTIN ZUIDHOF *Poultry Science/Bioeconomic Modeling*



POULTRY RESEARCH FINDING HEALTHY WAYS TO HELP FEED THE WORLD

Poultry is a huge industry in Colombia. The birds help feed the country's nearly 50 million people, and it's the most heavily consumed meat, making up 48 per cent of a person's meat intake.

When **Doug Korver**, a poultry researcher in the Department of Agricultural, Food & Nutritional Science, travelled to Colombia for a six-month sabbatical, he was excited to work with an industry that's not only important, but also in a place where he could make a difference.

"In the developing world, consumer demands about meat quality don't matter as much as they do in, say, North America," said Korver. "People are hungry and they need to eat, and that's the most important thing. The cheapest meat that's also a high-quality protein is most likely to be bought, and that's chicken."

Korver studied broiler chickens, animals that are genetically selected to produce meat and chosen for muscle growth and meat yield – Korver calls them the Great Danes of the chicken world. Colombia produced approximately 750 million broilers in 2016.

The study involved seeing if giving vitamin D and carotinoids together would increase bone quality, breast meat yield and pigmentation (in South America,

consumers prefer yellow chicken skin). Korver says the research team didn't see the dramatic effects they expected, but there were benefits. Carotinoids have anti-oxidants that get into the meat, thus increasing the shelf life and passing the anti-oxidants on to the consumer.

Two other projects followed from this trial.

One studied whether giving laying hens (the Chihuahuas of the chicken world) a vitamin D compound would affect eggshell quality. Not only did the compound increase shell quality, but also bird health.

Another study was a trial in Ecuador that looked at alternatives to growth-promoting antibiotics. Researchers looked at essential oil blends, organic acids, prebiotics and probiotics.

"The industry is going away from antibiotics in poultry, but you can't just remove antibiotics and keep everything else the same," said Korver. "Under the commercial farm conditions, the chickens fed the antibiotic alternatives did just as well as the animals fed antibiotics."

Korver's research in Colombia was an opportunity for the Faculty of Agricultural, Life & Environmental Sciences professor to have an impact using his training, experience and skills.

"It's about healthy birds, the efficiency of the product and the quality of the product," said Korver.



Doug Korver

USING TINY BUGS TO BUILD BIGGER CATTLE

Leluo Guan spends much of her time thinking about the rumen, the so-called “first stomach” in cattle, and microbes (bugs) living inside. She hopes to find ways to make cattle gain weight more efficiently, while at the same time burping and farting less.

It may not sound glamorous, but Guan, a researcher in the Department of Agricultural, Food & Nutritional Science, loves being a pioneer in her field. Working with cattle, she feels she has a lot to learn and a lot to contribute.

“Compared to what we know about humans, there are so many things we don’t know about cattle rumen microbiota,” she says. “It’s the complexity, and the challenge.”

Beef can be a notoriously expensive food to produce, and a majority of that expense comes from feed cost. Cattle producers have spent countless generations breeding and managing their animals in an attempt to make them more

feed-efficient—able to pack on more pounds on less feed. But little work has been done to understand, at a microbial level, the process of fermentation and digestion that occurs within the rumen.

At the same time, cows famously contribute to greenhouse gas emissions, because cattle microbial digestion produces plenty of methane. Guan hopes to help out in that department as well.

“We want to find particular bugs and/or bug-produced products—like enzymes, compounds or peptides—that will let cattle digest food more efficiently and produce less methane.”

While Guan enjoys her research, she is equally devoted to teaching. “As researchers, sometimes we focus on trying to publish papers, or get grants,” she observes. “I love teaching. I never say no if someone asks me to do a guest lecture. And I always create opportunities for students to work in my lab.”

As a professor in the Faculty of Agricultural, Life & Environmental Sciences, Guan not only contributes her own research, she also helps inspire future researchers. She’s a proud recipient of a 2017 Killam Annual Professorship, a University of Alberta award that honours combined excellence in research and teaching.

“Mentorship is, for me, always a priority,” Guan, a 2018 Great Supervisor Awardee, says. “It’s not just about students coming to class/my lab, and finishing their degrees. I want to mentor them, not only to do research, but to also help them grow as people—with the skills to solve problems and to establish good working relationships with others.”



A RISING STAR IN POULTRY MEDICINE



After two weeks in animal science 200 with professor **Frank Robinson**, **Teryn Girard** knew she had found home.

“The poultry team in the Faculty of Agricultural, Life & Environmental Sciences is a supportive community that paved the way for me and my future, and it was something I had been searching for,” said Girard, who recently finished a food animal practicum and is heading to work with vet Frank Marshall in Camrose.

When Girard started her university career, she was a shy student. But through her master’s degree under supervisors Clover Bench and Martin Zuidhof and mentor Robinson from the Department of Agricultural, Food & Nutritional Science, she blossomed.

“I became a lot more outgoing,” said Girard. “I found my passion in teaching and spoke at conferences.”

After finishing her graduate work studying the behaviour and welfare of precision-fed birds, Girard began vet school at the University of Calgary. She originally planned to be a small animal vet, but she kept coming back to chickens.

“Chickens came naturally to me, and I always enjoyed when the ALES professors taught at vet school,” said Girard. “After being mentored by Frank and Martin, it just felt right.”

Girard is excited about working as a food animal vet alongside Marshall. She will be working on chickens and pigs and incorporating her master’s work in animal welfare and behaviour to help producers manage their flocks and get the most out of their animals in humane ways.

“I feel like I’m exactly where I belong,” says Girard. “I’m so happy with my career choice so far.”

She plans to continue to hone her poultry medicine skills and, inspired by her ALES professors, would like to teach in the future.

“Those guys are the best of the best in ALES,” she said. “They do amazing work.”

It didn't take long for Teryn Girard to realize that working with chickens was where she was supposed to be.

FOOD SCIENCE & BIORESOURCES TECHNOLOGY

MARLENY ARANDA-SALDAÑA *Food/Bio Engineering Processing* **MIRKO BETTI** *Food Chemistry and Technologies*
DAVID BRESSLER *Fermentation and Bio/FoodEngineering* **HEATHER BRUCE** *Carcass and Meat Science*
LINGYUN CHEN *Canada Research Chair, Plant Protein Chemistry and Technology* **JONATHAN CURTIS** *Lipids and Analytical Chemistry*
MICHAEL GÄNZLE *Canada Research Chair, Microbiology and Probiotics* **LYNN MCMULLEN** *Food Microbiology*
ROOPESH MOHANDAS SYAMALADEVI *Food Safety and Engineering* **FERAL TEMELLI** *Food Process Engineering*
AMAN ULLAH *Utilization of Lipids, Polymer/Material Chemistry* **THAVA VASANTHAN** *Grain Science and Technology*
WENDY WISMER *Sensory and Consumer Science* **JOHN WOLODKO** *AITF Strategic Chair in Bio and Industrial Materials*
JIANPING WU *Food Protein Chemistry*



EGG PROTEIN'S HIDDEN TREASURE

As any budget-conscious undergrad can tell you, eggs are an inexpensive source of high-quality protein. **Jianping Wu**, a professor in the Department of Agricultural, Food & Nutritional Science, is working to unlock potential hidden within this economical, readily available protein—chemical compounds called bioactive peptides.

“My research is trying to discover those small fragments in the food protein that may have numerous bioactivities,” explained Wu. (A bioactivity simply means an effect on living tissue.) “Proteins are larger molecules, made up of hundreds of amino acids. The peptides we are studying are made of several amino acids. So, these are small molecules.”

Peptides have bioactive effects only after they are released from protein molecules. So, starting with ordinary egg protein, Wu and his team in the Faculty of Agricultural, Life & Environmental Sciences are working to identify possibly useful peptides, to prepare and purify them, and to study their characteristics and evaluate their effects.

Wu is excited by the possibilities. “What can these peptides do for our health? That is the significance of our research.”

Wu and his team are studying the effectiveness of peptides in lowering blood pressure in spontaneously hypertensive rats, a model with similar pathophysiology to human essential hypertension. “These peptides can reduce blood pressure,” said Wu. Hypertension (high blood pressure) is a chronic condition that afflicts millions of people worldwide.

And that may be only the beginning. “We’re also interested to see the effect of these peptides on insulin resistance,” Wu said. “Insulin resistance is the underlying cause factor for metabolic syndromes such as Type 2 diabetes. We are finding out if peptides can reduce blood glucose by improving insulin sensitivity.”

The list goes on. “This peptide may also hold the promise of improved bone health. And we’re looking at anti-aging properties as well.”

Peptides have one major advantage over conventional pharmaceuticals, says Wu. “The peptides we are using are from food protein—they are part of the protein we normally eat,” he explains.

Eventually, Wu hopes peptides may boost Alberta’s agriculture sector. “Looking for opportunities to develop these natural health products, or functional foods, presents new marketing opportunities.”



OUR SENSES AND FOOD: A HIGHLY PERSONAL RELATIONSHIP

Wendy Wismer is passionate about people's behaviour and perceptions around food products. There are so many academic areas involved in analyzing our food choices – nutrition science, psychology, sociology, statistics...

The discipline of sensory and consumer science evolved from sensory evaluation and is one of the four pillars of food science, alongside food microbiology, food chemistry and food processing.

Wismer's research includes working with cancer patients and 3D printed technology, and it's all about food awareness through our senses.

TASTE AND SMELL ALTERATIONS IN CANCER PATIENTS

Many cancer patients smell and taste food differently than the rest of the population. This can lead to decreased appetite, weight, energy and protein levels, and ultimately a reduced quality of life.

"Often those quality of life aspects are overlooked, but they're so important," said Wismer, an associate professor in the Department of Agricultural, Food & Nutritional Science, who began working with cancer patients in 2002.

Alongside **Vicky Baracos**, a professor in the Department of Oncology at the Cross Cancer Institute, Wismer researches how taste and smell alterations affect cancer patients' food choices. Although these changes don't affect everyone the same way, many patients report that coffee, chocolate and meat taste bitter and unpleasant, while some choose bland food or soft textures.

Once Wismer helps a patient identify how

their taste and smell perceptions have affected their enjoyment of food, she can help them make healthy food choices.

"When you have cancer there are so many things to think about," said Wismer. "And thinking about menus and food planning is a lot of time and work, so the more support the patients have, the better."

The intervention is ready, said Wismer, and the next step is to secure funding.

Wismer is also looking to develop nutrient-enhanced food products, such as oat-based smoothies, that will appeal to everyone's senses of taste and smell as much as possible.

INNOVATIVE WORK IN CONSUMER SCIENCE AND 3D PRINTING

Why do some people happily order elk meat, while others balk at the sight of an edible insect?

The consumer science behind why people make their food choices and how their perceptions of food products influence their decision to consume those products is a fascinating subject for Wismer. She is working alongside **Sven Anders**, a professor in the Department of Resource Economics and Environmental Sociology, and groups from the University of Bonn in Germany and Catholic University of the Sacred Heart in Italy, to conduct online consumer surveys.

Participants record the first four words that come to mind when they read the name of different meats, such as elk, bison and wild boar, as well as insects and more mainstream meats. Other questions are about variety seeking, family size and personal interest in sustainability and health.

Associations and beliefs about food products that first come to mind are important for food choice and provide insight about non-taste factors that influence consumer consumption of these protein sources.

Research begins this summer.

On the more technical side, Wismer and some of her students are exploring the world of 3D printed food alongside **John Wolodko**, an associate professor in the Department of Agricultural, Food & Nutritional Science. They're looking at the spatial distribution of tastants in the 3D printed food and people's perceptions of the benefits and technology used for 3D printed food.

"We want to know if people see the benefits of 3D printed food, from a nutritional or artistic angle, for example," said Wismer. "And we want to look beyond Canada, to other countries where printed food might be a real advantage to helping feed people in different ways."

The research is in the early stages, and Wismer's graduate students are developing questionnaires and working with a variety of foods, including chocolate.



Wendy Wismer

SENSORY SCIENTISTS HAVE A FEEL FOR FOOD

Our relationship with food and our senses is complex. There are people who gag on fruit pieces in yogurt, love the crunch of a water chestnut or recoil at the smell of broccoli. The sensory properties of food – smell, sound, appearance and texture – are important reasons why we like or dislike certain products, and food companies dedicate a wealth of resources to sensory research and development.

One of these resources is a sensory science researcher.

“Sensory science involves how people perceive food products using their five senses,” said **Carly Flemming**, ‘14 BSc Nutr/FdSci, a sensory scientist with Weston Foods in the Toronto area.

Flemming works with super tasters, many of whom are from southern Ontario and bring experienced, wine-tasting palates and food language fluency. The tasters are trained to use a scale to rate intensities. For example, a taster will eat an apple and rate its taste as floral, sweet, sour, and so on. The tasting results are shared with breeders and farmers to help inform their production planning to meet consumers expectations. (Interesting note: it takes about 10 years to get a new apple product on the market.)

“Companies are looking to reduce cost and change processes to make products better for consumers,” said Flemming.

The characteristics of food are what drew Flemming to the field of sensory science. She started at the University of Alberta with a plan to be a registered dietician, but one class guided her in a different direction.

“A lecture with Wendy Wismer about the realm of sensory science inspired me,” said Flemming. “And I liked that as a student I was allowed to participate in several different courses, including food technology and nutrition. The variety gave me a lot of knowledge to take forward.”

Flemming did an internship at Agriculture and Agri-Food Canada’s Lacombe Research and Development Centre, where she worked on the impact of livestock feed on the flavour and texture of meat products.

She went on to graduate studies at the University of Guelph, completing a master’s in food science with a specialty in sensory science. After working at Vineland Research and Innovation Centre in southern Ontario and McCain Foods in Toronto, Flemming now works at Weston Foods’ bakery division.

“We’re seeing a focus on more healthful foods and reducing sugar and salt with maintaining flavour and texture,” she said. “We want to make indulgent products healthier.”

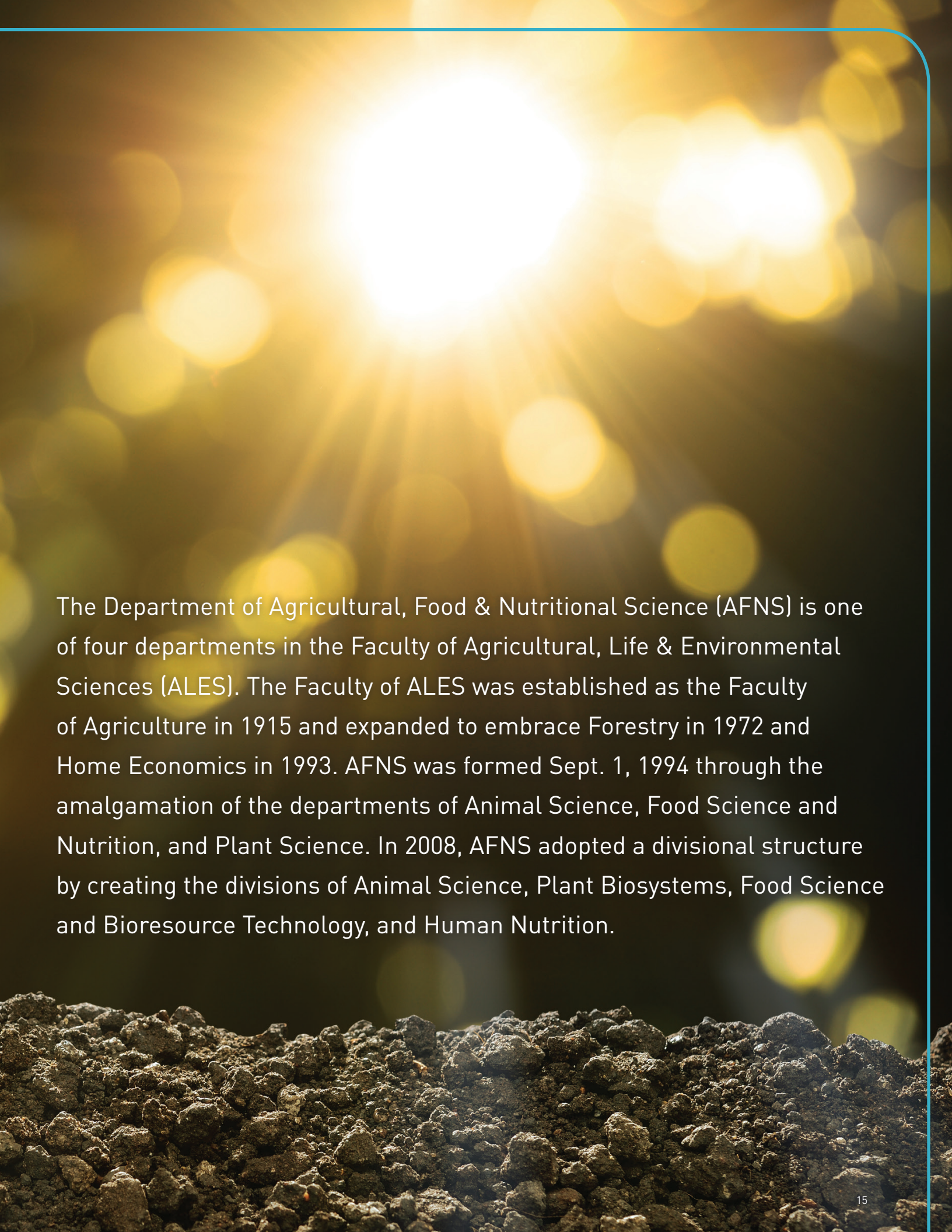
The field of sensory science is growing, according to Flemming.

“It’s surprising the impact real-world application has on fresh, nutritious products,” she says. “The consumer is top.”



Carly Flemming works with super tasters to help determine what foods consumers hunger for.





The Department of Agricultural, Food & Nutritional Science (AFNS) is one of four departments in the Faculty of Agricultural, Life & Environmental Sciences (ALES). The Faculty of ALES was established as the Faculty of Agriculture in 1915 and expanded to embrace Forestry in 1972 and Home Economics in 1993. AFNS was formed Sept. 1, 1994 through the amalgamation of the departments of Animal Science, Food Science and Nutrition, and Plant Science. In 2008, AFNS adopted a divisional structure by creating the divisions of Animal Science, Plant Biosystems, Food Science and Bioresource Technology, and Human Nutrition.



HUMAN NUTRITION

HEIDI BATES *Director, Integrated Dietetic Internship* **RHONDA BELL** *Human Nutrition*
JEAN BUTEAU *Human Nutrition* **CATHY CHAN** *Human Nutrition* **ANNA FARMER** *Community Nutrition*
CATHERINE FIELD *Nutrition and Metabolism* **RENÉ JACOBS** *Human Nutrition*
DIANA MAGER *Clinical Nutrition* **VERA MAZURAK** *Nutrition and Metabolism*
CARLA PRADO *CAIP Chair, Nutrition, Food and Health* **SPENCER PROCTOR** *Metabolic and Cardiovascular Diseases*
CAROLINE RICHARD *Canada Research Chair, Nutritional Immunology* **DONNA VINE** *Human Nutrition*
JENS WALTER *CAIP Chair, Nutrition, Microbes and Gastrointestinal Health* **NOREEN WILLOWS** *Community Nutrition*



A GLUTEN-FREE FOOD GUIDE FOR KIDS WITH CELIAC DISEASE IS COMING

For some parents, getting their children to eat healthy is a chore, but for parents who have children with celiac disease, the challenges of healthy eating are even greater.

Diana Mager, an associate professor in the departments of Agricultural, Food & Nutritional Science and Pediatrics, conducted a study that examined the dietary intake of children with celiac disease, an autoimmune disease that results in an immune response to eating gluten. The results? A gluten-free diet was significantly low in folate, a B vitamin that's key to making DNA and red and white blood cells.

"A gluten-free diet often has a heavy reliance on processed foods, and those products are higher in fat and sugars and low in micronutrients," said Mager. "There are also no mandatory guidelines to fortify gluten-free grain products with folate."

When Mager realized there were no evidence-based nutrition guidelines for children with celiac disease, she knew she had to create them. She is now working on a gluten-free food guide for kids. After

analyzing the diets of more than 300 kids with celiac disease, she is now evaluating what needs to be in the guide to ensure kids get their nutritional needs met and the guide is feasible.

Mager is getting input from dietitians, gastroenterologists such as her co-investigator **Justine Turner**, doctors and nurses as well as members of the community with children who have celiac disease to help her figure out what information families need, and what, specifically, celiac children need.

"The celiac diet is a specialized diet that requires major lifestyle changes, especially since this is the only way to treat celiac disease," said Mager. "It's more expensive and there are issues with the nutritional quality of foods, but it is possible for this diet to be healthy – people just need guidance."

There is a desire for trusted, tested, reliable information, said Mager.

"For children, this is really important."

Mager hopes to have a first draft of the guide available for testing by fall 2019. She also has plans for an adult guide.

"About 25 per cent of Canada's population is eating gluten-free because of perceived health benefits, but it's not necessarily healthier," said Mager. "We need to help families make healthy, informed choices."



Diana Mager

NEW DIABETES TREATMENTS ON THE HORIZON

On Jan. 23, 1922, the work of **Dr. Frederick Banting**, his assistant **Charles Best** and biochemist **James Collip** (a University of Alberta professor) turned into the first successful insulin test on a human patient with diabetes. Nearly a century later, diabetes researchers are still looking for new ways to treat the disease.

There are three major types of diabetes: type 2 diabetes (the most common diagnosis); type 1 diabetes; and gestational diabetes (occurs during pregnancy and is usually temporary). Prediabetes is another diagnosis that indicates an elevated risk of developing diabetes.

Jean Buteau, a biochemist and associate professor in the Department of Agricultural, Food & Nutritional Science, has dedicated his life's work to diabetes research. His research focuses on diabetes, and more particularly pancreatic beta-cells.

Pancreatic beta-cells are specialized cells that produce and secrete insulin in order to regulate blood glucose. Diabetes is caused by the destruction of beta-cells or a decline in their function. Buteau and his team study the molecular mechanisms governing beta-cell life and death so they can design drugs to target those newly discovered mechanisms to expand or protect beta-cells and cure diabetes.

Their latest research results unravelled a new role for a gene called Lyn in diabetes.

"We discovered that Lyn protects beta-cells and increases their capacity to secrete insulin in mice with or without diabetes," said Buteau. "Similarly, removing Lyn in transgenic animals precipitates the development of diabetes. We obtained a patent describing those results."

The Canadian Institutes of Health Research recently funded the project.

Buteau's laboratory is now testing small molecule activators of Lyn in animal models of diabetes, and they are collaborating with a biotech company based in Philadelphia.

It's exciting news for the 11 million Canadians living with diabetes or prediabetes, as well as their loved ones.

"Our project may ultimately offer new treatments to diabetes patients," said Buteau.



Jean Buteau

RESCUED FOOD RESCUES HUNGRY FAMILIES



For the many hungry Edmonton area families, food donation programs are lifesavers.

Refugees who go days without eating, malnourished pregnant women, and children who have no breakfast and no lunch to take to school – these are just some of the people who rely on donated food from programs such as The Grocery Run.

The Grocery Run is a food rescue initiative that emerged from a study that looked at the effects of economic and cultural barriers on maternal health. The study was conducted by **Rhonda Bell**, a professor in the Department of Agricultural, Food & Nutritional Science, and **Maria Mayan**, '90 BSc(HEc), a researcher with the Women and Children's Health Research Institute at the U of A.

Launched in the summer of 2016, The Grocery Run collects food that would otherwise be thrown away because it's blemished or the packaging is damaged and distributes it to families who often

don't know what their next meal will be. The project solves the immediate crisis for daily food and serves about 115 families weekly.

Two other Department of Agricultural, Food & Nutritional Science alumnae who have been deeply involved with The Grocery Run are **Sandra Ngo**, '12 BSc(Nutr/Food) and **Morgan Allen**, who will soon convocate with a BSc in nutrition. Ngo was a community resource co-ordinator and helped manage the program, working alongside volunteers and cultural brokers, who are vital links to families in need. Allen took over Ngo's position, and her interest in sustainability and community nutrition made The Grocery Run a natural fit.

Allen's education in the Faculty of Agricultural, Life & Environmental Sciences helped Allen better understand food insecurity and work on short- and long-term solutions.

The Grocery Run works to provide same-day emergency food to pregnant and

postpartum women and their families, especially as they settle into their new lives in Canada. As the demand for food continues to grow, Allen works to build relationships with food vendors through her work with the Leftovers Foundation, a charity that facilitates food rescue across the city.

It's estimated that approximately 7,200 people will access The Grocery Run in one year. Each family receives a bag of food every week, with one bag providing enough food for one to two meals.

The University of Alberta Alumni Association has since become involved, connecting The Grocery Run with alumni volunteers who help run the program.

It's clear the issue of food insecurity and the desire to help feed the hungry is something people are passionate about, especially graduates of the department who are inspired by their peers and professors.



PLANT BIOSYSTEMS

EDWARD BORK *Mattheis Chair in Rangeland Ecology and Management* **CAMERON CARLYLE** *Rangeland Ecology*
GUANQUN (GAVIN) CHEN *Canada Research Chair, Plant Lipid Biotechnology* **LINDA HALL** *Environmental Biosafety and Integrated
Weed Management* **NAT KAV** *Biochemistry and Biotechnology* **JOCELYN OZGA** *Plant Physiology and Horticultural Science*
HABIBUR RAHMAN *Canola Breeding and Research* **DEAN SPANER** *Plant Breeding and Organic Agriculture*
STEPHEN STRELKOV *Plant Pathology* **RONG-CAI YANG** *Statistical Genomics and Quantitative Genetics*

RESEARCHER MAKES WHEAT BREEDING HISTORY AT THE U OF A



Dean Spaner

Dean Spaner and his wheat breeding group have made history in the Department of Agricultural, Food & Nutritional Science by having five hard red spring wheat (Canadian western red spring, CWRS) cultivars accepted for registration in a single year.

To put that in perspective, between 1959 (when records became readily available) and 2012, the University of Alberta registered and released one CWRS cultivar.

“This is a large step forward in providing different genetics for yield, straw strength, early maturity and disease resistances,” said Spaner.

A professor from the plant biosystems division in the Department of Agricultural, Food & Nutritional Science, Spaner’s new cultivars are Tracker, Jake, Ellerslie, Sheba and RedNet. These CWRS wheat lines are adapted to Alberta’s climate, providing some security to wheat farmers in a changing climate. The lines show improved yield – some as high as 13 per cent – and some also mature early, a significant development for wheat production in Alberta, especially north of Red Deer where the growing season is shorter.

“We only have 99 days in our growing season in Alberta north of Red Deer. Early maturity means you can harvest faster, and you

have less downgrading of the crop, less frost damage and less pre-harvest sprouting,” Spaner explained.

“Some of these new cultivars are extremely early, which is a focus of our breeding program.”

Canada has one of the world’s most stringent regulatory systems when it comes to releasing wheat varieties. It takes between eight and 12 years to develop a wheat cultivar. It must be field tested in roughly 50 environments over five years and tested for many agronomic traits, including yield and maturity, as well as disease resistance and quality traits.

“Up until the 1990s, Alberta had one or two varieties of wheat growing on millions of acres,” said Spaner. “That, of course, leads to problems if a disease comes – it will wipe out a whole crop. It’s a serious monoculture problem.”

These new wheat cultivars will help secure wheat production in Western Canada.

“Breeding for resistance is important,” said Spaner. “And the release of new varieties provides farmers with alternatives to tackle agronomic problems.”

PROVIDING SOLUTIONS FOR THE CANOLA INDUSTRY



The year **Habibur Rahman** came to Alberta, clubroot had just been spotted in Alberta canola fields. While the soil-borne disease affects many plants in the Brassica family — including cabbage, cauliflower, and mustard — it can be particularly devastating to canola.

“The yield loss due to clubroot is about 30 per cent; however, it can be up to 100 per cent,” explains Rahman, who heads the canola breeding program in the Department of Agricultural, Food & Nutritional Science.

This makes the disease bad news for the pocketbooks of canola producers, but also for the nation as a whole. According to 2017 research conducted by the Canola Council of Canada, the crop contributes \$26.7 billion to the economy each year and supports 250,000 jobs.

Clubroot is caused by a fungus-like pathogen that causes galls — tumour-like growths — to form on the roots, restricting a plant’s water and nutrient uptake. The disease can result in decreased seed production and even premature death of the plant. There are no economical methods for removing the disease from

the soil, which means producers can only protect their fields by planting disease-resistant cultivars of canola.

This makes Rahman’s work so important for the industry. Not long after arriving in Alberta, he began working on the development of a clubroot-resistant canola cultivar in Canada via the Department of Agricultural, Food & Nutritional Science’s canola breeding program.

With funding from the Natural Sciences and Engineering Research Council and other funding agencies, such as the Alberta Canola Producers Commission (ACPC) and Agriculture and Agri-Food Canada (AAFC), and support from an industry partner (Nutrien Ag Solutions, formerly Crop Production Services), Rahman and his team experimented with 250 Brassica accessions for resistance to this disease, introgressed resistance into Canadian canola, and identified two genes for the development of what the industry calls a double-resistant cultivar.

By 2016, the research produced the first double-resistant hybrid cultivar, and canola producers across the province could breathe a sigh of relief.

But, nature can be cruel. Within just a couple of years, Alberta’s plant pathologists began seeing new strains or pathotypes of clubroot capable of infecting the formerly disease-resistant plants. Although disappointing, the emergence of new strains came as no surprise to Rahman: “We know when we work with a pathotype that there will be change.”

With new funding from Alberta Innovates, AAFC, Alberta Agriculture & Forestry, and canola growers associations including ACPC, Rahman is on the hunt for new sources of resistance to protect the industry once again. He expects it will take four to five years to develop a new cultivar — significantly longer than the two or three years it takes the clubroot pathogen to evolve.

In fact, he says it’s possible — even likely — that there will never be a permanent solution to the problem of clubroot.

While many would find this frustrating, Rahman isn’t kept awake at night by the strong possibility that his work will never be finished. “I’m a canola breeder and it’s my job.”

ALUMNA'S CAREER SPROUTS FROM HANDS-ON AG RESEARCH

Growing up on a mixed farm near Three Hills, Alta., **Nicky Lansink**, '16 BScAg, '18 MSc, became fascinated by agriculture at a young age. Always happy to roll-up her sleeves on the farm, she used her spare time to learn even more as part of her local 4-H youth club.

"I always had beef projects and was very hands-on with livestock as a kid," she said. "It led me to study animal sciences and agriculture."

Lansink headed to the University of Alberta after high school to earn a bachelor of science in agriculture and went on to graduate studies with the intention of building a career in the beef industry.

"I thought it would be neat to be really involved in the industry, leading efforts to make the industry better as a whole," she says.

Working under the supervision of the Department of Agricultural, Food & Nutritional Science's **Ed Bork**, an expert in rangeland ecology and management, and **Graham Plastow**, an expert in animal genomics, Lansink's thesis compared the performance and methane emissions of cattle with low- and high-residual feed intake (RFI) in both dry lot and pasture environments. RFI is a measure of how efficiently cattle use the feed they consume; those with low-RFI are considered efficient as they require less feed to grow than their high-RFI counterparts.

"I wanted to know whether the efficient animals were actually eating less and whether they were growing more or less than the inefficient animals, as well as which animals were producing the least amount of methane," explains the Faculty of Agricultural, Life & Environmental Science grad.

Lansink examined the differences in performance of genomically predicted high and low RFI cows and calves on pasture at the university's Mattheis Research Ranch, located north of Brooks, Alta. She also used GrowSafe technology — a suite of research tools designed to help cattle producers make strategic breeding decisions — to collect and analyze data from a group of replacement heifers made up of high- and low-RFI individuals.

At the Lacombe Research Centre, a dry lot environment, she collected data on feed intake, methane emissions and performance (including factors like weight, back fat and muscle) of the heifers. After a season on the ranch and a few months at the Lacombe Research Centre, she moved the heifers back to the university's Mattheis Research Ranch to see how well each type of animal would fare in a pasture environment.

Ultimately, her research results were mixed. In the dry lot in Lacombe, the low RFI heifers both consumed and produced less methane than the others, but the results weren't replicated on pasture at the Mattheis Ranch. However, Lansink still found an overall trend towards inefficient animals eating more and producing more methane than their efficient counterparts. Additionally, she found no difference in performance among genomically predicted high and low RFI cows, suggesting that selection for feed efficiency should not affect animal performance.

Even before the completion of her thesis, Lansink earned an award for her work at the 2015 Livestock Gentec conference. There, she had the opportunity to present her research to industry, including representatives from GrowSafe Systems, an Alberta agritech start-up company. Impressed with her work, the company invited her on a month-long trip to Australia to meet with current and prospective clients and researchers. "Being there really made the link for me — that what I was doing in my research was something people in the industry were looking for and could apply," she said.

Seeing the potential of the company to help both producers and the environment, she connected with GrowSafe about job opportunities and was hired as a research analyst. While Lansink admits her field work could be grueling, conducting research in real agricultural settings gave her the practical skills and knowledge to transition easily from academia to industry.

"The hands-on component of my research really prepared me for what I'm doing now," she said. "I think it's made communication with our customers a little bit easier because I've been there and done that, and have an idea of what they're trying to achieve."



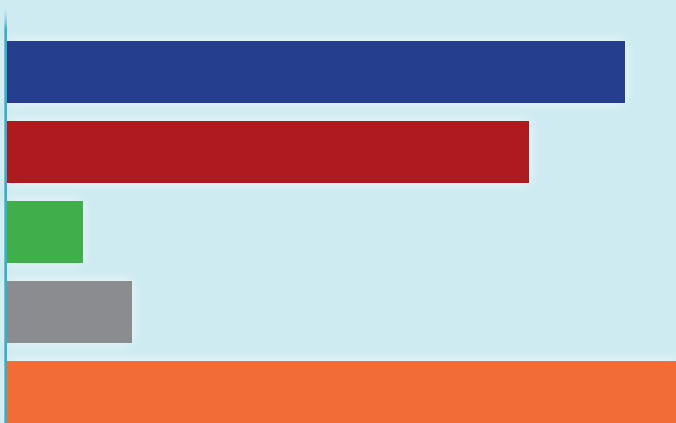
Nicky Lansink



PARTNERS & FUNDERS 2018 -19

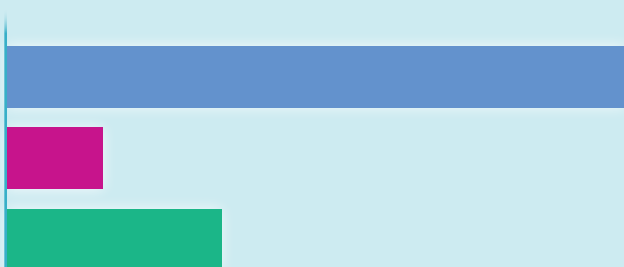
Acadian Seaplants Limited	Canadian Field Crop Research Alliance	Mitacs Inc.
ADISSEO	Canadian Foundation for Dietetic Research	Monsanto Fund
Agriculture and Agri-Food Canada	Canadian Institutes of Health Research	Networks of Centres of Excellence - GlycoNet
Agriculture Funding Consortium:	Canadian Poultry Research Council	National Pork Board
• Alberta Barley Commission	Canadian Swine Research and Development Cluster	Natural Sciences and Engineering Research Council of Canada
• Alberta Canola Producers Commission	Canola Council of Canada	New Leaf Essentials (West) Ltd.
• Alberta Chicken Producers	Canterra Seeds	Organic Federation of Canada
• Alberta Crop Industry Development Fund	Ceapro Inc.	PIC USA Inc.
• Alberta Innovates-Bio Solutions	Climate Change and Emissions Management Corporation	PolicyWise for Children & Families
• Alberta Livestock Meat Agency Ltd.	Dairy Farmers of Canada	Prairie Oat Growers Association
• Alberta Milk	Dairy Farmers of Manitoba	Red Bow Ranching Ltd.
• Alberta Pulse Growers Commission	Edmonton International Airport	Saskatchewan Milk Marketing Board
• Alberta Wheat Commission	Egg Farmers of Alberta	Saskatchewan Pulse Growers
• Egg Farmers of Alberta	Egg Farmers of Canada	Saskatchewan Wheat Development Commission
• Western Grains Research Foundation	Elmira Pet Products Ltd.	SeCan Association
Alberta Agriculture and Forestry	Engage Agro Corporation	Social Sciences and Humanities Research Council of Canada
Alberta Hatching Egg Producers	FMC Corporation	Sunterra Farms Ltd.
Alberta Health Services	Forge Hydrocarbons Corporation	The Hanor Company of Wisconsin, LLC
Alberta Innovates	FP Genetics	The W. Garfield Weston Foundation
Alberta Pork	Genesis Inc.	Trojan Technologies Inc.
Alberta Turkey Producers	Genome Alberta	University Hospital Foundation
Alltech Canada Inc	Genome Canada	Université de Montréal
Almased Wellness GmbH	Genome Prairie	University of Calgary
Barley Council of Canada	Heart & Stroke Foundation of Canada	University of California, Los Angeles
BC Dairy Association	Hypor LP	University of Guelph
Beef Cattle Research Council	Ingredion Inc.	University of Saskatchewan
Biena Inc.	Kellogg Company	University - Iowa State
Bioindustrial Innovation Canada	Kaiser Foundation Research Institute	Valent
Burnbrae Farms Ltd.	Kidney Foundation of Canada	Western Economic Diversification Canada
Canada Foundation for Innovation	Lallemand Animal Nutrition	Westgen
Canada Malting Company Limited	Lilydale Inc. – A Sofina Foods Company	
Canada Research Chairs	Maple Leaf Foods Inc.	
Canadian Beef Breed Council		
Canadian Celiac Association		

BY THE NUMBERS



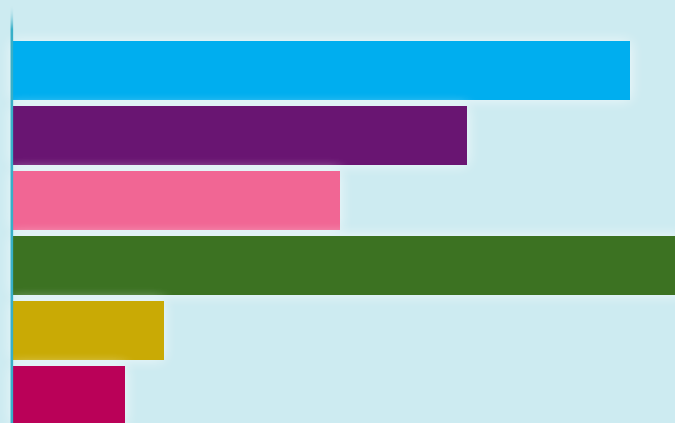
RESEARCH FUNDING

■ Alberta provincial government	\$ 8,811,661
■ Federal government	\$ 6,199,371
■ Other government	\$ 975,171
■ Industry	\$ 1,468,886
■ Other	\$ 9,554,758
Total research funding 2018-19:	\$ 27,009,847



OPERATING FUNDS

■ Academic, administrative and teaching support	68% of total funds
■ Central laboratories	8.5% of total funds
■ Research stations	23.5% of total funds
Total operating funds 2018-19:	\$16,197,781



ACADEMIC STAFF

■ Professors*	65
■ Adjunct professors	45
■ Professors emeriti	32
■ Post-doctoral fellows	68
■ Research associates	17
■ Visiting scientists/students	15

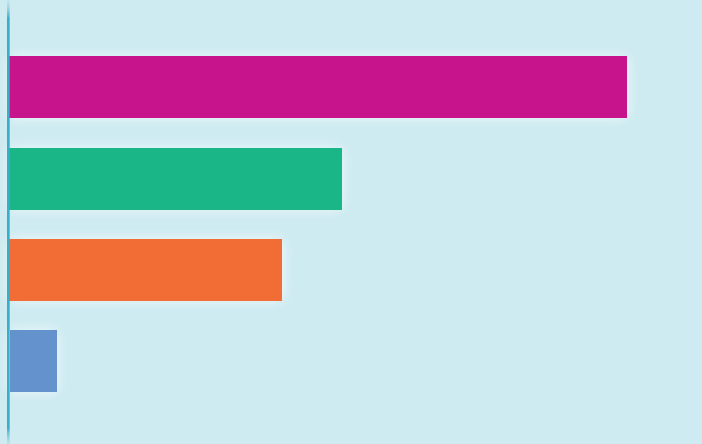
Refereed publications **226** (Jan. to June 2018)

Oral/poster presentations + abstracts **426** (Jan. to June 2018)

** including AAFC and ARD academic work affiliates/cross and joint appointments*

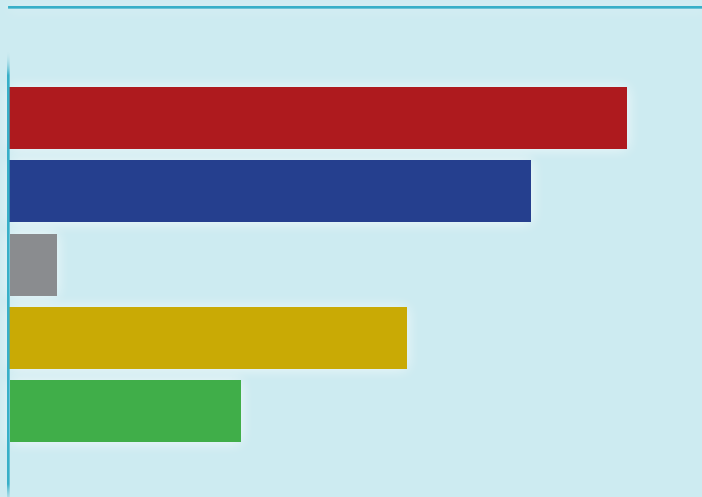
TECHNOLOGY TRANSFER

Commercial agreements (licences and options)	6
Technologies with patent protection initiated	7
Reports of invention	17
Material transfer agreements	20



UNDERGRADUATES ENROLLED IN DEGREE PROGRAMS

■ BSc in Nutrition and Food Sciences	482
■ BSc in Animal Health	194
■ BSc in Agriculture	169
■ BSc in Agriculture/Food Business Management	43



GRADUATE STUDENT ENROLMENT

■ Doctoral students	129
■ Masters students	114
■ Visiting students	11
■ New graduate students in 2018-19	85
■ Graduate students convocated in 2018-19	52

CENTRAL LABORATORIES

- Agri-Food Material Science Unit
- Agriculture Genomics and Proteomics Unit
- Chromatography facilities
- Food science facilities
- Nutrition and metabolism facilities
- Human Nutrition Research Unit
- Plant growth facilities
- Proximate analysis facilities

OFF-CAMPUS RESEARCH FACILITIES

- Agri-Food Discovery Place
- Alberta Poultry Research Centre
- Crops & Land Resources Unit
- Dairy Research and Technology Centre
- Laird W. McElroy Metabolism and Environment Research Unit
- Swine Research and Technology Centre
- Enclosed Composting Facility
- Feedmill
- Ministik Field Station
- Roy Berg Kinsella Research Ranch
- St. Albert Research Station
- Mattheis Research Station



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